

Technical Report 1138

**Virtual Environments for Dismounted Soldier
Simulation, Training, and Mission Rehearsal:
Results of the FY 2002 Culminating Event**

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September 2003



**United States Army Research Institute
for the Behavioral and Social Sciences**

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FOREWORD

The U.S. Army needs a capability to effectively simulate the performance of dismounted soldiers in virtual simulations. In current fielded systems, such as the Close Combat Tactical Trainer, dismounted combatants are involved in the combined arms operation in an artificial and generally unsatisfactory manner. Virtual simulation can provide a means for dismounted leaders, soldiers and units to train effectively over a wide range of conditions. The same technologies can also be used for development of new Infantry concepts and doctrine and applied to development of mission planning and rehearsal tools. The capability to use effective virtual simulations for dismounted combatants has implications for training of today's dismounted leaders and soldiers and for the development of effective Objective Force concepts and systems.

Emerging Virtual Environment (VE) technologies, such as low cost computer image generators, locomotion platforms, intelligent computer-controlled forces, and immersive displays, have the potential to provide training, mission rehearsal, and experimentation capabilities for dismounted soldiers and leaders. However, the potential of VE is currently unrealized because critical hardware and software, documented effective training methods and strategies, and training support tools need to be developed and integrated.

In response to this need, the U.S. Army Research Institute Simulator Systems (ARI-SSRU) and Infantry Forces Research Units (ARI-IFRU), the U.S. Army Simulation, Training, and Instrumentation Command (STRICOM), and the U.S. Army Research Laboratory Human Research and Engineering Directorate (ARL-HRED) and Computational and Information Sciences Directorate (ARL-CISD) participated in a joint Science and Technology Objective (STO) entitled "Virtual Environments for Dismounted Soldier Simulation, Training and Mission Rehearsal." This four-year effort (FY99-FY02) was focused on overcoming critical technological challenges that prevented effective dismounted soldier simulation. This report describes an assessment of progress in meeting STO objectives conducted by the participating organizations at Fort Benning, Georgia in September 2002.

The results of this program will be used to influence future dismounted soldier simulation development efforts. The results were briefed to the Objective Force Warrior Open Review in October 2002 and to the Warrior Systems Tech Base Executive Steering Committee in December 2002. A special report and video on the overall STO results are being prepared to disseminate the results to Army decision makers.



SCOTT E. GRAHAM
Acting Technical Director

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The research described in this report could not have been conducted without the combined efforts of a large number of people. In addition to the authors of this report, they include the following:

- Bryan Clark, University of Central Florida, who analyzed the questionnaire data.
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- Michael Dayton, SAIC, who supported DISAF operation.
- Paul Barham, Charles Brown, Brian Plamondon, and Brian Stewart, Advanced Interactive Systems, who supported Soldier Visualization Station operation
- Andrew Neiderer, ARL-CISD, who supported Dynamic Terrain development.
- And especially the soldiers who participated.

VIRTUAL ENVIRONMENTS FOR DISMOUNTED SOLDIER SIMULATION, TRAINING, AND MISSION REHEARSAL: RESULTS OF THE FY 2002 CULMINATING EVENT

EXECUTIVE SUMMARY

Research Requirement:

The U.S. Army Research Institute Simulator Systems (ARI-SSRU) and Infantry Forces Research Units (ARI-IFRU), the U.S. Army Simulation, Training, and Instrumentation Command (STRICOM), and the U.S. Army Research Laboratory Human Research and Engineering Directorate (ARL-HRED) and Computational and Information Sciences Directorate (ARL-CISD) participated in a joint Science and Technology Objective (STO) entitled "Virtual Environments for Dismounted Soldier Simulation, Training and Mission Rehearsal." This four-year effort (FY99-FY02) is focused on overcoming critical technological challenges that currently prevent high fidelity dismounted soldier simulation. The research objective is to develop a dismounted leader trainer at the fire team, squad, and platoon level. Leader trainees will be able to execute a series of realistic training scenarios (combat operations and support operations) in the simulator. Repeated practice, enhanced by training features, coaching, and After Action Reviews (AARs) will build decision-making and coordination skills. Computer-controlled or semi-automated agents will represent subordinates, other friendly forces, enemy forces, and civilians. The intent is to have a training system that is realistic and effective, yet requires a fairly low level of personnel support for subordinates and role players.

During each year of the STO there have been two major types of activities: research and technology development, and preparation for and conduct of a culminating event (CE). The purpose of the CE is to insure the compatibility of the technologies under development and to obtain soldier feedback on their use. This report describes the activities and results of the FY 02 CE.

Procedure:

The FY 02 CE was held in August 2002 at Fort Benning, Georgia. The objectives were to integrate and evaluate the technologies developed during the year. The key technologies included: a Dismounted Infantry Virtual AAR System; new behaviors and improved operator control for Dismounted Infantry Semi-Automated Forces (DISAF); soldier control of DISAF through Voice Recognition and Synthesis; enhancements to the soldier simulator, the Soldier Visualization Station (SVS); and a dynamic terrain server.

Following final system integration and testing, Infantry soldiers participated in a series of scenarios in the virtual environments (VEs), with three groups of six soldiers participating for two days each. During that time they completed eight or nine exercises in urban areas, each consisting of a mission pre-brief, planning, mission execution, and an AAR.

Findings:

The CE provided a realistic and challenging test of the systems and capabilities under development. It identified both accomplishments and areas for improvement. The systems generally performed well, both as independent systems and as coordinated components of a larger, integrated system. When problems were encountered, the causes could usually be identified, and in some cases corrected, during the CE. Problems that could not be corrected immediately were identified as high priority items for post-CE correction.

The developments made during the course of the STO made it possible to run much more complex and sophisticated scenarios than those that could be run in 1999. In the 1999 CE all scenarios were basically the same: initiate movement to a specified building, react to enemy contact in route, resume movement and finally assault the building. It was always daylight. DISAF could not enter buildings. Few civilians were present, and their behaviors were limited to either standing still or moving on a preplanned route. Buildings could not be breached. Neither force could use smoke or grenades. A hit always equaled a kill. A fire team leader could control DISAF only by giving a verbal command to the DISAF operator, who then implemented that command at his console. Routes for DISAF had to largely be scripted in advance. AARs were limited to linear playback on a stealth viewer. In 2002, there were six different scenarios. Scenarios could be conducted at any time of day or night. DISAF could go anywhere, and could carry out some highly sophisticated behaviors, such as room clearing, autonomously. Civilians moved about freely, as individuals and in crowds, and could be armed. Holes could be blown at any location in any building. Flares, smoke, and grenades were available to all participants. Soldiers could be wounded as well as killed when hit. These factors greatly increased the variety and realism of the training situations that could be presented.

Technical improvement resulted in increased training effectiveness. AARs could jump directly from one critical event to another and view them from any perspective. Both leader self-ratings and independently-obtained performance scores indicate that leader and unit skills improved with practice in VE. However, the training was not equally effective for all types of leader tasks. In general, leaders felt that their skills improved more on coordination, communication, and control tasks than on specific unit tasks or battle drills, such as clearing a building.

Utilization of Findings:

The results of this effort will be used to guide the development and application of future dismounted soldier simulation capabilities.

VIRTUAL ENVIRONMENTS FOR DISMOUNTED SOLDIER SIMULATION, TRAINING, AND MISSION REHEARSAL: RESULTS OF THE FY 2002 CULMINATING EVENT

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VIRTUAL ENVIRONMENTS FOR DISMOUNTED SOLDIER SIMULATION, TRAINING, AND MISSION REHEARSAL: RESULTS OF THE FY 2002 CULMINATING EVENT

Introduction

Army Need

The U.S. Army requires vastly improved dismounted soldier simulation capabilities to meet multiple needs. The first need is for simulations that allow dismounted leaders, soldiers and units to train effectively even if they do not have frequent opportunity to participate in high fidelity field training exercises. In addition, leaders, soldiers and units need effective mission rehearsal tools that prepare them for specific combat missions in all types of terrain. Finally, U.S. Army decision makers need inexpensive and high fidelity prototyping and testing systems that will allow them to explore and evaluate potential doctrine, organization, equipment, and soldier characteristics. These needs are very important today. They are likely to become more important as the Army transformation continues.

Virtual Environment (VE) technologies, such as low cost computer image generators, locomotion platforms, intelligent computer-controlled forces, and immersive helmet mounted displays, have the potential to provide training, mission rehearsal, and experimentation capabilities for dismounted soldiers and leaders. However, the potential of VE is currently unrealized because no one has yet solved critical hardware and software limitations, documented effective training methods and strategies, or created the training support packages necessary to use it.

In response to these needs, the U.S. Army Research Institute Simulator Systems (ARI-SSRU) and Infantry Forces Research Units (ARI-IFRU), the U.S. Army Simulation, Training, and Instrumentation Command (STRICOM)¹, and the U.S. Army Research Laboratory Human Research and Engineering Directorate (ARL-HRED) and Computational and Information Sciences Directorate (ARL-CISD) participated in a joint Science and Technology Objective (STO) entitled "Virtual Environments for Dismounted Soldier Simulation, Training and Mission Rehearsal." This four-year effort (FY99-FY02) focused on overcoming critical technological challenges that currently prevent high fidelity dismounted soldier simulation. These critical challenges include: simulating locomotion; tracking weapons and body positions; creating realistic performance of computer-controlled dismounted friendly and enemy soldiers; simulation of night equipment and sensor images; making terrain and structures dynamic; developing appropriate training strategies and methods; assessing individual and unit performance; and determining transfer of training from virtual to live environments. The effort builds on previous efforts of the participating organizations in the development and use of virtual simulations.

¹ As a result of a re-organization on 1 October 2002, the participating element within STRICOM became a part of the Research, Development, and Engineering Command Simulation Technology Center. Given that the work was performed while it was a part of STRICOM, that name will be used in this report.

The original objective of the STO was to produce a demonstration of a High Level Architecture (HLA)-compliant integrated dismounted soldier simulation system that would include the following components and capabilities:

- A locomotion platform which provides realistic perception of movement and accurate energy expenditure.
- A visual display system which can simulate a variety of night vision sensors and equipment accurately.
- "Intelligent" computer-controlled forces to represent enemy, friendly and neutral forces.
- Dynamic Terrain (DT), including damage to structures, rubble and other micro-terrain obstacles.
- Features to enhance the effectiveness of training and mission rehearsal.
- Demonstrated effectiveness of the system.

This effort addressed several required U.S. Army future operational capabilities described in U.S. Army Training and Doctrine Command (TRADOC) Pamphlet 525-66 "Future Operational Capability" (U.S. Army, 1997), including:

- The capability to provide highly realistic training through means other than on-the-job or field training in numerous areas, including training for dismounted soldiers and small group leader training.
- The capability to use advanced simulation as a means of providing training to achieve proficiency in critical combat skills.
- Realistic, advanced simulation capabilities to train/mission rehearse tasks that require multiple repetitions to achieve proficiency when repetitions would not otherwise be possible.
- The ability to conduct simultaneous interactive training for the total force.
- Simulations which have the dual capability of being an effective training tool, as well as providing the ability to evaluate warfighting concepts and battle planning.
- Simulations and simulators which allow testing, and validation of Doctrine, Training, Leader Development, Organization, Materiel, and Soldier (DTLOMS) issues.²
- The need to rehearse missions on the terrain and under the conditions that simulate the next deployment as closely as possible.
- Realistically simulated friendly and opposing forces necessary to train/mission rehearse tasks realistically within advanced simulation.
- The capability to develop and deliver training and mission rehearsals, on demand, to meet contingency mission requirements.

Prior Related Research

Prior to the initiation of the STO, each of the participating government organizations had initiated research and development programs related to the use of VE for dismounted soldier simulation. This was largely a result of the influence of Gorman (1990), who was an early proponent of the use of VE for dismounted infantry (DI) training. Partly as a result of his efforts,

² These are currently referred to as Doctrine, Organization, Training, Material, Leadership, Personnel, and Facilities (DOTMLPF) issues.

a conference was held in Snowbird, Utah in 1990 to discuss individual soldier systems and the role that an individual portal (or I-Port) would play in their development (Goldberg and Knerr, 1997). Although consensus was achieved on the need for an I-Port, Operation Desert Storm preempted the initiation of a cooperative effort. The conference did provide the impetus for individual research programs, however.

ARI Virtual Environments Research

The ARI effort began with an initial examination of the feasibility of using VE technology for dismounted soldier training and the identification of difficult technical problems and research issues (Levison and Pew, 1993). This was followed shortly with a more detailed examination of dismounted Infantry (DI) unit tasks and expected VE capabilities (Jacobs et al., 1994). With these reports as a basis, ARI initiated an in-house research program to investigate critical behavioral science research issues involved in dismounted soldier simulation. The initial four experiments were conducted to investigate interface effects on the capabilities of participants to perform simple tasks in VE (Knerr, Lampton., Singer, Witmer, and Goldberg, 1998). Variables investigated included the type of control device, amount of practice on the tasks, stereoscopic versus monoscopic helmet-mounted displays (HMDs), and type of display device (monitor, boom, or HMD). Two experiments were then conducted that addressed the effectiveness of VE for teaching the configuration of, and routes through, large buildings, and the transfer of the knowledge acquired to the real world. These results led to the initiation of a program of basic research into the investigation of distance estimation in VE. ARI then investigated the use of VE to represent exterior terrain, both for training land navigation skills (identifying landmarks and learning routes), and performing threat assessments. The most recent research has investigated the use of VE for training team tasks, both in terms of training strategies and features (Lampton, McDonald, Rodriguez, Morris, and Parsons, 2001) and the effects of geographically distributed team members on training effectiveness (Singer, Grant, Commarford, Kring, and Zavod, 2001). The overall program is reviewed, with a focus on the evolution of VE technologies, in Lampton, Knerr, Martin, and Washburn (2002).

STRICOM VE Research

Dismounted Warrior Network (DWN) was a STRICOM program to develop a reliable, low-cost, easy-to-use capability to insert dismounted soldiers into VE. A series of engineering and user experiments was conducted during 1997 to explore the utility of a DWN system as a research and analysis tool and to investigate different interfaces for inserting dismounted soldiers into virtual simulations. A joint government-contractor team selected Virtual Individual Combatant Simulators (VICS) based on three criteria: a desire to have a diverse mixture of characteristics to examine; a cost/benefit assessment of system characteristics; and expected system availability. Following VICS selection, performance and interoperability issues were identified and resolved. Finally, the various VICS, a DI Semi-automated Forces (SAF) station, an Exercise Support Station, and an AAR Station were tied into a distributed interactive simulation (DIS) network and installed at the Virtual Simulation Lab, Fort Benning, Georgia. An initial set of experiments was conducted using this configuration. They showed that the DWN

could be used to assess the utility of the emerging "immersive" simulation technologies (Lockheed Martin, 1997) both from a part-task engineering perspective and from a mission-oriented user perspective. ARI-SSRU and ARI-IFRU participated in the design and conduct of the experiments. (See Pleban, Dyer, Salter, and Brown, 1998.)

A follow-on project to DWN, entitled DWN Enhancements for Restricted Terrain (DWN ERT), focused on Military Operations in Urban Terrain (MOUT). New low-cost VICS were modified based on lessons learned in the first set of experiments. New locomotion methods were introduced, improved low-cost visual systems were incorporated, and new aiming techniques were implemented. In addition, DISAF was modified to support operations inside buildings. Experiments were conducted in July 1998 with these modified systems. The goal of this round of experiments was to investigate how well a fire team of VICS and DISAF could support MOUT tasks at the individual soldier, fire team, squad, and platoon levels. Engineering experiments, live tests at the McKenna MOUT site, and user experiments were conducted. The results are documented in the DWN ERT Final Report (Lockheed Martin Corporation, 1998) and Salter, Eakin, and Knerr (1999).



Figure 1. The Uniport.

ARL-HRED Research in Mobility Interface Devices

One component of the I-Port concept (Gorman, 1990) was an interface device that translated the soldier's movements into movement through the VE. This interface device was intended to require the user to expend the same amount of physiological energy to move through the VE as would be required to move through the real environment. To demonstrate that such a device could be built, Sarcos Research Corporation built the Uniport™ in 1994 (Figure 1). On the Uniport, the user pedals to go forward and backward. Turning is accomplished by applying pressure to the side of the seat. ARL-HRED conducted human factors studies with the Uniport in 1996 (Savick, Krausman, Leiter and Faughn, 1996 and Krausman, Savick, Leiter, Faughn and Knapik, 1997). Although the Uniport demonstrated the concept of an interface device that required the user to expend physiological energy to move through the VE, the user's movements on the Uniport (pedaling) are not as normal a motion for moving around the battlefield as walking or running.

The Omni-Directional Treadmill (ODT) (Carmein, 1996) allows the user to walk and run in any direction (Figure 2). It was built in 1996 and taken to STRICOM and Fort Benning as part of the DWN and DWN ERT programs. In the Engineering Experiments and the User Experiments, the ODT was recognized as the locomotion interface device that permitted the most natural locomotion (Lockheed Martin Corporation, 1997). However, it also had some problems that limited its performance. The problems included misalignment of the user's heading with the vector along which the ODT returns the user to the center of the active area, false starts, overshooting stops, and difficulty side stepping and turning in place. It was also noisy, 85 dB(A) at high speeds (Darken, Cockayne and Carmein, 1997). In 1998, the ODT was moved to ARL-HRED and these problems were addressed.

ARL-CISD Research in Dynamic Terrain

The ARL began research in dynamic terrain in 1996 with the Army Experiment 3 demonstration at the Association of the United States Army (AUSA) conference. Research in this area centers on distributed simulation methods and protocols, computational geometry, and real time graphics. In the area of distributed simulation, DIS protocols were investigated for efficiency in distributing dynamic terrain changes (Thomas, 1998). Work by Neiderer in efficient real time algorithms for computing holes in polygons (Neiderer, Thomas, and Pearson, 1998) enabled the simulation of wall breaching. Work by Neiderer and Hansen on distribution methods of rubble and debris (Neiderer and Hansen, 2001) provided insight into the distribution problem.

The ARL-CISD contributed to the STRICOM DWN program by providing algorithms for wall breaching. Work with the VE STO continued the development and transition of ARL developed distributed dynamic terrain research with the development of the Dynamic Terrain Server to include wall breaching, dings, rubble and debris, and physics-based wall damage.

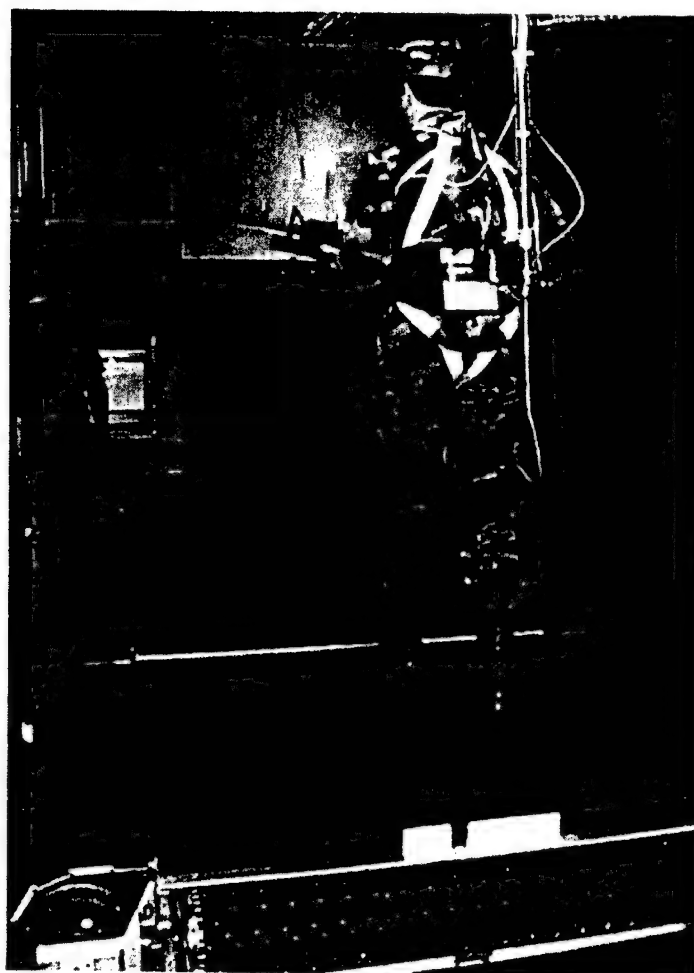


Figure 2. The original Omni-Directional Treadmill (approximately 1997).

STO Vision

The goal of the STO research was to develop a dismounted leader trainer at the fire team, squad, and platoon level. Leader trainees will be able to execute a series of realistic training scenarios (combat operations and support operations) in the simulator. Repeated practice, enhanced by training features, coaching, and AARs will build decision-making and coordination skills. Computer-controlled or semi-automated agents will represent subordinates, other friendly forces, enemy forces, and civilians. The intent is to have a training system that is realistic and effective, yet requires a fairly low level of personnel support for subordinates and role players. It was initially believed that the use of networked individual simulators for collective training, training all members or key members of units together, would not be cost effective. Nevertheless, the developments made under the STO support that type of use as well.

History of the STO

During each year of the STO there have been two major types of activities: research and technology development, and preparation for and conduct of a CE. The purpose of the CE is to insure the compatibility of the technologies under development and to obtain soldier feedback on their use. The first year CE was held at Fort Benning in September 1999. Its objective was to evaluate the improvements made in supporting technologies for Infantry soldier simulation since the DWN ERT experiments of 1998 (Lockheed Martin, 1998).

The second year CE was held at the STRICOM Technology Development Center (TDC), and Institute for Simulation and Training (IST) at Central Florida Research Park, Orlando, FL in September 2000. The objectives of the second year CE were to insure that products were compatible and integrated, and to evaluate progress in DISAF behaviors, voice and gesture recognition, and night vision simulation. Specific training research issues were also investigated by ARI IFRU during this time (Pleban, Eakin, and Salter, 2000; Pleban, Eakin, Salter, and Matthews, 2001).

The FY 01 CE was held in September 2001 at Fort Benning, GA. As in previous years, the general objectives were to integrate and evaluate the technologies developed during the year. The specific technologies involved included an AAR system, voice recognition and synthesis as a means of interacting with and controlling DISAF, individual soldier simulator enhancements, an improved version of the ODT, a dynamic terrain server, additional DISAF behaviors, and a mission planning and rehearsal tool. The FY 01 CE is documented in Knerr et al (2002). Pleban and Beal (2002) evaluated approaches for simulating night vision goggles in the Soldier Visualization Station (SVS) during this period as well.

FY 02 Objectives

The FY 02 CE was held in August 2002. As in previous years, the general objectives were to integrate and evaluate the technologies developed during the year. The specific technologies involved, and the evaluation objectives for each, are described in the following paragraphs.

Dismounted Infantry Virtual After Action Review System (DIVAARS)

The key capabilities of DIVAARS are digital videodisc (DVD)-like replay with synchronized audio and video, including the capability to jump to pre-designated segments or views, and tabular data summaries. Enhancements made during the year included a "Windows-like" interface, addition of the capability to view building interiors, correction of problems with voice communication capture and replay, and new visual effects. The aspects of the system to be evaluated were: its capability to capture and present information generated by other systems; its usability under reasonably realistic conditions; and its capability to provide the information requested by soldiers and AAR leaders.

Voice Recognition and Synthesis

Voice recognition was used by a Fire Team Leader to control DISAF subordinates. Voice synthesis was used by DISAF to acknowledge a command, indicate failure to understand a command, indicate completion of a task, or report that they have come under fire. FY 02 enhancements included efforts to improve recognition accuracy and natural language compatibility, and to incorporate DISAF spontaneous speech. Evaluation issues were recognition accuracy, correctness or appropriateness of DISAF responses to voice commands, and appropriateness of the synthesized voice responses.

Soldier Visualization Station (SVS) Enhancements³

The SVS is a realistic immersive 3D virtual simulator. Recent enhancements included: lighting improvements, including streetlights and interior building lights that can be shot out and extinguished; incorporation of electrical transformers into the database; tracer rounds; airborne and thrown flares; fragmentation and concussion grenades; entity wounding (visual and performance effects); satchel charge (model and effects); armed civilian entity; and incorporation of a binocular capability (hardware and software). Evaluation issues were the usability and realism of the new capabilities.

Dynamic Terrain Server (DTServer)

The DTServer provides a means to blow holes in buildings sized appropriately for the munition and building material and to create rubble in addition to the hole. Evaluation issues were: the comparability of the results (hole size and shape) across the various platforms in the CE; the comparability of the implementation in both the visual and structural (Compact Terrain Database (CTDB), for DISAF) databases; and the perceived realism of the holes and rubble.

Dismounted Infantry Semi-Automated Forces (DISAF)

In addition to establishing compatibility with the DTServer and SVS, improvements were made to DISAF to model smoke/stun grenades, C4 explosives, higher-fidelity wounding, an armed civilian, various crowd units and corresponding behaviors, a hostage behavior, a sniper shooting behavior, formation keeping, and the addition of a joystick control mode. The DISAF joystick control mode and sniper shooting capabilities were not available for use during the CE and consequently were not evaluated. Evaluation issues were the appropriateness and realism of the new behaviors, and their impact on DISAF operator workload.

³ The Infantry Center and School uses the term Squad Synthetic Environment (SSE) to describe the integrated set of dismounted soldier simulators which are individually referred to by the developer (Advanced Interactive Systems, Inc.) and developing agency (STRICOM) as the Soldier Visualization Station (SVS). This report will use SVS to refer to an individual simulator, and SSE to refer to the integrated set of SVSs.

As part of the STO during FY 2002, but independent of the CE, Pleban and Salvetti (2003) investigated issues related to mission rehearsal and transfer of training from virtual simulations to a real world urban training area.

Approach

The VE for Dismounted Soldier Simulation STO FY 02 CE was held at the Dismounted BattleSpace BattleLab Virtual Simulation Lab, Fort Benning, Georgia. The first three days were devoted to equipment set-up, integration, and testing. Six days conducting scenarios with Infantry soldiers followed, with three groups of soldiers participating for two days each. The final day was devoted to packing and shipping equipment. In addition to the government organizations already identified, Quality Research, Inc., Advanced Interactive Systems, Inc. (AIS), TRW, Inc., and the University of Central Florida's IST supported the CE.

Technological Capabilities Evaluated in the FY 02 CE

Dismounted Infantry Virtual After Action Review System (DIVAARS)

DIVAARS was developed to meet two needs. The first was to provide soldiers with a common understanding of what happened during an exercise and why it happened, so that they can identify ways to improve their performance. The second was to facilitate data analysis, in order to support both training feedback and research and development. Determining what happened during an exercise is particularly difficult in an urban environment, because buildings and other structures break up the visual field and limit the portion of the battlefield that can be observed by any one person.

The AAR system connects to the network used by the soldier simulators and DISAF, and permits observation and recording of the exercise data. AAR Leaders are central to the design and operation of DIVAARS. They observe what happens during the conduct of an exercise and prepare a presentation that will lead the unit to an understanding of what happened, why it happened, and how to do better. Their presentation should be both interactive and efficient.

A description of key DIVAARS capabilities follows. The emphasis is on unique DIVAARS capabilities. Figure 3 shows a sample DIVAARS display with many of these features.

Playback. Playback controls include actions such as pause, stop, record, play, step forward, fast-forward, rewind, fast reverse, and step reverse. Variable playback speeds are available. The AAR Leader also has the capability to mark events during the exercise, and jump directly to them during the AAR.

Viewing Modes. Multiple viewing modes are available during both the exercise and the AAR.

- **Preset Views** – An unlimited number of preset views can be selected at any time prior to or during the exercise for immediate use.

- Top-Down – A view of the database looking straight down from above. It can be moved left, right, up, down, and zoomed in or out. It can also be locked onto an entity, in which case it will stay centered directly above that entity as it moves through the database.
- 2D View - This is the traditional plan view display. It is the same as Top-Down except that depth perspective is not shown.



Figure 3. AAR system main display.

- Entity View – Displays what a selected entity (including enemy or civilian) sees, including the effects of head turning and posture changes.
- Fly Mode – The AAR Leader can “fly” through the database using the mouse for control.

Movement Tracks. Movement tracks show, in a single view, the path an entity travels during an exercise. Markers are displayed at fixed time intervals.

Entity Identifier. Friendly force avatars in the DIVAARS, as in the virtual simulators, are identical. A unique identifier, as given in the entity marking field of the DIS Entity State Protocol Data Unit (PDU), is shown above the avatar of each unit member.

Digital Recording and Playback of Audio Program. DIVAARS records and plays back audio content for all scenarios.

Viewing Action inside a Building. The AAR Leader can select a building and then select a floor of that building to be displayed. Using this feature, the operator can view and display the avatars going through a building without the problem of upper floors or outer walls blocking the view.

Dynamic Terrain Changes. DIVAARS receives the PDU messages from the DTServer and updates the display with any changes.

Bullet Lines. Bullet flight lines are shown for all weapon firings. The line traces a shot's origin and destination. It is the same color as the originating entity. These bullet lines gradually fade away.

Event Data Collection and Display. DIVAARS has the capability to track many events including shots fired, kills by entities, movement, and posture changes. These data can be shown in a tabular format or graphical display. Ten different tables and graphs are available:

- Shots fired, by entity and unit
- Kills, by entity and unit
- Killer-Victim table that shows who killed whom, the angle of the killing shot (front, flank, or back), and the posture of the victim (standing, kneeling, or prone)
- Shots as a function of time, by entity, unit, and weapon
- Kills as a function of time, by entity, unit, and weapon
- Kills by distance from killer to victim, by entity, unit, and weapon
- Rate of movement of each entity, and averaged at team/squad levels
- Percentage of time friendly units were stationary
- Percentage of time friendly units were in different postures
- Display of user-defined events

SVS Enhancements

The SVS is an immersive 3D virtual simulator. It uses a PC-based rear-screen projection system to present 32-bit color images in 1024 X 768 resolution on a screen approximately 10 feet wide by 7.5 feet high. The soldier can stand, kneel, or lie prone within a ten-foot square enclosure. The soldier can move within this enclosure, and his movement is tracked and reflected in perspective changes in the VE, but typically remains centered in that space. The immersed soldier's head and weapon are tracked using an acoustic and inertial tracking system. The soldier navigates through the environment via a thumb switch located on the weapon. Figure 4 shows a soldier in an SVS. The software used for the FY 02 CE included capabilities developed during this year's development effort. Specific enhancements are described below.

Lighting. AIS modified existing 3D OpenFlight databases to include scene illumination from streetlights and interior building lights. The ability for lights to be "shot out" was

incorporated to improve the simulation of night operations by soldiers equipped with night vision devices.

Transformers. A model of a transformer was created and attached to specified buildings in both the Fort Polk and McKenna databases. Lights were identified that were associated with each transformer. Destroying the transformer with explosive charges or small arms fire extinguished the associated lights.



Figure 4. Soldier in an SVS.

Tracers. Rifle tracer rounds were implemented at specified shot intervals.

Flares. The capability to launch flares was added to the SVS. Flares can be either thrown by hand or launched using the soldier's rifle interface. These flares can be of various colors and last for a specified duration. Rifle-launched flares fall at a steady rate, illuminating the surrounding region in the database. The trajectory of these launched flares is affected by the wind setting selected for a scenario.

Grenades. The ability to throw grenades was completed and refined this year. Grenades are "thrown" using the soldier's rifle interface, and will bounce off objects such as walls if they are struck. Fragmentation grenades kill or wound entities within a defined radius from the explosion. Flash/bang grenades temporarily "blind" users in an SVS if they are within range and line of sight. This is accomplished by flooding the screen with white and gradually fading back into the scene.

Entity Wounding. Human entity wounding was implemented on AIS human animation characters. Boston Dynamics Incorporated's DI-Guy, also supported by SVS, does not provide access at the level required to implement wound effects. SVS provides visual wound models on

its characters and supports display of wounding effects, such as limping, on character animation. The SVS wounding model divides the body into seven segments: head, torso, left arm, right arm, left leg, right leg and weapon. Two health states are maintained: one for mobility and one for general health. On a per-munition basis, the user can define an "immediate" and "time based" percent damage for each health state (mobility, general). Immediate damage is assessed against the body part in question as a deduction from 100%. Time-based damage deducts the damage percentage from the body part on a regular, user-specified time interval. This allows for degradation over time. When the percent damage for a body part reaches 0%, that body part is "disabled." Torso and head health states of 0% constitute a fatal kill. Right arm health state of 0% prevents firing a weapon. Left arm health state of 0% prevents throwing objects (grenades, flares, etc). Mobility state directly (and linearly) affects speed of movement. Movement is prevented when the mobility state reaches 0%. The soldier's avatar is forced prone when both legs are shot. An indirect fire model has been implemented as well. When an indirect munition hits within range, a body part is selected at random and the damage model is applied to both health states of that body part as if it were direct fire.

A 2D status icon on the SVS screen shows which body parts are wounded and which are healthy. This is necessary to provide the soldier with feedback as to his status, since he would not necessarily know why some capability was suddenly lost (e.g., shooting, standing) without this feedback.

Satchel Charge. AIS created visual models of small, medium, and large C4 explosive satchel charges as well as a character animation supporting charge placement on buildings to blow holes for ingress. Figure 5 shows the large satchel charge, and Figure 6 shows a charge being placed on a building.

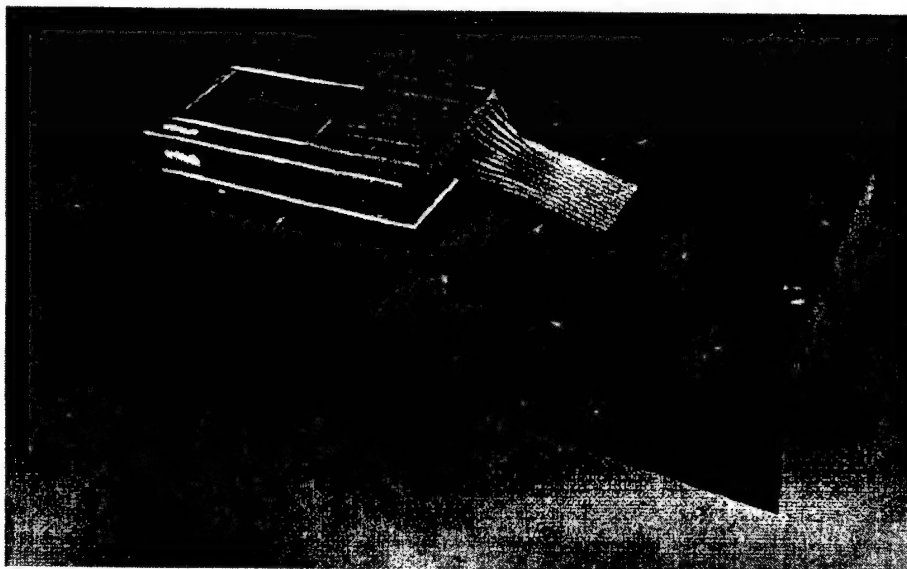


Figure 5. Large satchel charge model.

Armed Civilian. Scenarios were developed in which an apparently unarmed civilian entity draws a concealed weapon (pistol). AIS developed a character that supported this capability.

Binoculars. AIS modified its second visual channel display to implement a virtual binocular capability. The user can look into the binoculars and see the virtual image and zoom in/out at preset discrete steps. Two sets of virtual binoculars (N-Vision VB-30 Hand Held Immersive Display) were provided. Only the squad leader had the binocular capability during the CE.

Night Vision System Integration. AIS integrated independently-developed night vision simulation software into the desktop version of the SVS. Night vision simulation was demonstrated but not used during the CE scenarios.

Dynamic Terrain. The SVS simulators had the capability to display the effects of holes being blown in buildings. This approach works in conjunction with ARL's DTServer.



Figure 6. Placing a satchel charge.

Dynamic Terrain

The DTServer made its debut at the FY 01 CE. The DTServer is Linux-based software that receives Detonation PDUs from the DIS network, processes the data, and distributes the results to other simulators on the network. The DTServer transmits two types of results to receiving simulators. The first is a 'ding' packet. A 'ding' results from small arms fire on a hard

surface. Upon receipt of a ding packet, the simulator displays a model of a simulated crater at the point of impact. The second result transmitted by the DTServer is a breach. A breach in the FY 01 CE resulted from an AT8 round impact on a building. In the FY 02 CE, breaches could be created by either AT8 rounds or C4 satchel charges. The receiving simulators received a Breach PDU followed by a series of Polygon Vertex PDUs. When all Polygon Vertex PDUs were received, the simulators removed the polygons in the breach area, and replaced them with the new polygons received on the network.

The development of the DTServer provided the necessary capability to compute and distribute dynamic terrain changes to the simulation network. The use of a server allows the addition and modification of algorithms without changes to other simulators on the network, reducing the costs of implementing dynamic terrain. Thomas (2003) provides a more complete description of the DTServer.

DISAF and Enhancements

DISAF was developed to provide a realistic representation of dismounted infantry and civilians on the virtual battlefield. The Infantry capabilities of simulations such as Simulation Network (SIMNET) SAF and Modular SAF (ModSAF) were limited to the low-fidelity viewpoint of tanks. The primary focus of DISAF has been the development of tactical behaviors for individual through squad level operations. DISAF is based on the ModSAF/OTB architecture. DISAF includes support for urban and rural terrain operations. Most of the DISAF behaviors are based on validated military Combat Instruction Sets (CISs). A database development process was developed to generate ModSAF/OneSAF TestBed (OTB) Compact Terrain Database (CTDB) Multiple Elevation Surface (MES) structures from visual database files. DISAF provides an enhanced 2D Plan View Display (PVD) to support display of MES buildings and new Individual Combatant (IC) icons. In addition, DISAF can be networked to a Stealth Viewer to provide a 3D display. DISAF runs on a PC under Linux or Windows NT. DISAF capabilities and behaviors are summarized in Table 1. Efforts during FY 02 focused on smoke/stun grenade modeling, C4 explosive modeling, advanced wound modeling, armed civilian, crowd units and behaviors, hostage behaviors, a sniper shooting behavior, formation keeping, and the joystick control of SAF ICs. The new capabilities added during the current year are characterized below in Table 2.

Table 1

DISAF Capabilities and Behaviors

| | |
|---|---|
| DISAF/CGF – Capabilities Entities and Units <ul style="list-style-type: none"> • US IC w/ M16A2, C4 Charges, and Fragmentation, Smoke and Stun Grenades • US IC w/ AT8, C4 Charges, and Fragmentation, Smoke and Stun Grenades • US IC w/ Squad Automatic Weapon (SAW), C4 Charges, and Fragmentation, Smoke and Stun Grenades • US IC w/ M203, C4 Charges, and Fragmentation, Smoke and Stun Grenades • US IC Fireteam A (M16, AT8, M203, SAW) • US IC Fireteam B (M16, M16, M203, SAW) • US IC Fireteam C (M16 x 3, SAW) • US IC Auto Weapons Team (M16 x 2, SAW) • US IC Squad (M16, Fireteam A, Fireteam B) • US IC Rifle Squad (M16, Fireteam B x 2) • US IC Auto Weapons Squad (M16, Auto Weapons Team x 3) • US IC Platoon (M16 x 2, Rifle Squad x 3, Auto Weapons Squad) • USSR IC AK47 • USSR IC Squad (AK47 x 6) • US IC Combat Medic • IC Armed Civilian w/ 9mm handgun • Crowd Units <ul style="list-style-type: none"> ▪ 5 Men In Suit ▪ 5 Men In Jacket ▪ 5 Women In Suit ▪ 5 Women In Skirt ▪ 5 IC Armed Civilian ▪ 4 Mixed Civilian ▪ 10 Mixed Civilian ▪ 20 Mixed Civilian • Civilians <ul style="list-style-type: none"> ▪ Man In Suit ▪ Man In Jacket ▪ Woman In Suit ▪ Woman In Skirt ▪ IC Physician ▪ IC Physician Assistant • Furniture • Structures <ul style="list-style-type: none"> ▪ Battalion Aid Station Structure ▪ Forward Surgical Team Structure ▪ Combat Support Hospital Structure • UH60Q Blackhawk Helicopter Ambulance • Bus Ambulance | BLUFOR Behaviors <ul style="list-style-type: none"> • Halt • Fire & Movement • Throw Grenade • Place Charge • Occupy Position • Fire at Location • React to Ambush • Suppressive Fire • React to Contact • Move on Path • Break Contact • Mount / Dismount Ground / Air Unit • Clear Room • Move Tactically • Climb Up / Down • Move Injured IC • Hold Hostage • Withdraw • Shoot Human • Station Keeping • IC Joystick Control |
| | Automated Urban Behaviors <ul style="list-style-type: none"> • Fireteam Clear Room • Squad Clear Room |
| | Autonomous OPFOR Behaviors <ul style="list-style-type: none"> • Look Around • Face Bogey • Engage Threat • Seek Cover • Watch • Engage from Cover • Fall Prone & Freeze • Freeze • Pursue Threat |
| | Autonomous Civilian Behaviors <ul style="list-style-type: none"> • React to Fire • Wander |
| Plan View Display (PVD) <ul style="list-style-type: none"> • Greater Zoom-In Capability (1:25 Map Scale) • View Multiple Elevation Structures (MES) interiors, one level at a time • MES windows, doors, and openings are distinguished by color • Can display entity altitude to indicate MES level • IC icons indicate posture and weapon position | Crowd Idle Behaviors <ul style="list-style-type: none"> • Do Nothing • Move Toward Crowd Center • Move To Nearby Civilian • Wander In Random Direction |

Table 1
DISAF Capabilities and Behaviors (Continued)

| Situation Awareness | Crowd Reaction Behaviors |
|---|--|
| <p>IC Sensors</p> <ul style="list-style-type: none"> • Aural: detects and locates entities from movement and gunfire • Visual: identifies and locates entities <p>Remembered Threats</p> <ul style="list-style-type: none"> • Visible entities • Entities located, but not visible • Entities known, but not located | <ul style="list-style-type: none"> • Do Nothing • Freeze • Lie Prone • Watch Combatant Forces • Move Toward / Follow Combatant Forces • Move Toward Gunfire • Move Toward Detonations • Move Toward Casualties • Move Away From Combatant Forces • Move Away From Gunfire • Move Away From Detonations • Move Away From Casualties |

Table 2
New DISAF Capabilities and Behaviors

| New Capability | Functionality Added |
|-----------------------------|---|
| Stun Grenade | <ul style="list-style-type: none"> Modeling of stun grenades. Enhanced "Throw Grenade" behavior to include the option to throw a stun grenade. |
| Smoke Grenade | <ul style="list-style-type: none"> Modeling of smoke grenades. Enhanced "Throw Grenade" behavior to include the option to throw a smoke grenade. |
| C4 Charges | <ul style="list-style-type: none"> Modeling of three different C4 charges (small, medium, large) with three different detonators. (time, proximity, absolute time) "Place Charge" behavior. Support to the SAIC MES DTServer to use the three new C4 charges. |
| IC Armed Civilian Entity | <ul style="list-style-type: none"> Armed civilian entity that may stow / deploy a weapon through the "Move On Exact Path" behavior. Modeling of a 9mm handgun weapon to be used by the Armed Civilian entity. |
| Crowds | <ul style="list-style-type: none"> Eight Crowd Units Crowd behavior that allows the SAF Operator to assign a specific Idle behavior and a specific Reaction behavior to the members of a Crowd Unit. |
| Medical Entities | <ul style="list-style-type: none"> Three medical ICs (IC Combat Medic, Physician, and Physician Assistant) Three medical vehicles (HMMWV Ambulance, Bus Ambulance, and UH60Q Blackhawk Ambulance) Three medical structures (Battalion Aid Station, Forward Surgical Team, and Combat Support Hospital) |
| Medical Behaviors | <ul style="list-style-type: none"> "Move Injured IC" behavior that allows an IC to move another injured IC entity. Enhanced the "Mount Ground / Air Unit" behavior to allow injured ICs to mount any ground or air units. Enhanced the "Dismount Ground / Air Unit" behavior to allow injured ICs to dismount any ground or air units. "Transfer Injured IC from DISAF to CTPS System" behavior that allows a medical IC to selectively transfer an injured (local entity) IC to the CTPS system for detailed medical modeling. |
| Wounding | <ul style="list-style-type: none"> IC targeting and wounding model that uses different zones of the body for targeting and damage assessment. |
| Shoot Human | <ul style="list-style-type: none"> "Shoot Human" behavior that allows an IC to shoot a specific body part on another life form entity. |
| Hold Hostage | <ul style="list-style-type: none"> "IC Hold Hostage" behavior that allows an IC to take a civilian entity as a hostage. |
| Station Keeping | <ul style="list-style-type: none"> "IC Station Keeping" behavior that allows ICs to keep in formation with a specified IC entity. |
| Joystick Control | <ul style="list-style-type: none"> Capability to control an individual IC's movement, weapon control and posture using a joystick. |
| Data Collection & Reporting | <ul style="list-style-type: none"> Statistical data collection and reporting capability to analyze: <ul style="list-style-type: none"> Time Exposed to Target Missed Shots |

Voice Control of DISAF

The goal of this project was to develop a reusable, HLA compliant Voice Federate (VF) that provides the capability for live and virtual participants in a simulation to interact through spoken voice statements. The live user can maintain command and control over synthetic entities (DISAF) while the synthetic entities can vocally acknowledge commands and provide information to the live participant. Key project objectives included developing the capability to accomplish the following:

- Recognize speech and convert it into a format compatible with DISAF
- Synthesize speech to allow DISAF to speak with live users
- Operate with US Army speech protocols while achieving a natural language capability
- Modify spoken command structures
- Create an HLA compliant interface that supports compatibility of the VF Simulation Object Model (SOM) and Real-time Platform Reference Federation Object Model (RPR FOM) for easy integration into DIS legacy environments
- Be independent of, but compatible with, the latest Commercial Off-The-Shelf (COTS) products for voice recognition and synthesis

The VF provides two modes of voice interaction with DISAF. The first mode allows a SAF operator to use voice to control the Graphical User Interface (GUI) for the SAF. The second mode allows a unit leader to interact vocally with synthetic units. A unit leader sitting at the SAF GUI can operate both modes simultaneously.

The FY 02 effort focused on the areas of synthetic speech, recognition accuracy, and natural language compatibility.

Synthetic Speech. The effort attempted to incorporate spontaneous synthetic speech. Spontaneous speech occurs when a CGF entity generates speech without prompting by a human participant. Spontaneous speech is envisioned to be used to allow the CGF entities to inform the human participant of key events, such as new enemy sightings ("spot reports") or announcing key changes in status ("taking fire" or "man down" reports). Ultimately, only the enemy spot reports were incorporated into the final product.

Recognition Accuracy. The VF suffered from very low speech-to-text (STT) accuracy rates during the FY 2001 culminating event. Therefore, it was a goal of the 2002 effort to overcome this issue. This was addressed using a variety of tools.

First, the grammar was modified from an exact sentence parse to one based on keyword recognition. In this system, the STT software produces a stream of text as the VF user speaks. When keywords appeared in the stream, the keyword and its location in the text stream were sent to the command parser. When appropriate keywords occurred close together, the command parser forms a complete command and sends it on to DISAF.

The second tool used to increase accuracy was a word filter. The COTS STT products investigated all produce nonsense syllables when presented with speech that they cannot match to their internal dictionaries. In addition, stripping the internal dictionaries to include only words

important to the VF grammar was problematical. The inclusion of a word filter effectively resolved both of these problems by filtering out all words not important to the VF grammar. In effect, the command parser is protected from all STT errors of inclusion.

The last technique used to increase accuracy was to map common STT errors to correct words via a renaming table. The renaming table maps natural language phrases to DISAF terms. The renaming table allowed live participants to refer to DISAF entities using natural language names without modifying the way the entities were referred to within DISAF. Thus, live teammates may refer to themselves by their real names when composing commands to SAF units. Likewise, key geographical features may be referred to by commonplace names regardless of how the feature is referred to within DISAF. Since the renaming table is many to one, multiple natural language names may refer to the same DISAF entity. Thus, a SAF fireteam named "2B" within DISAF may be referred to by "Two Bravo" or "Team Bravo" or "Fireteam Bravo" or any other number of natural names. This technique allowed for correction of common STT errors (e.g., "two bravo" is commonly interpreted as "to grovel" by STT software), and also provided a means to correct errors unique to individual VF users during the CE exercises.

Natural Language Compatibility. It was a goal of the FY 2002 effort to develop methods that allow human participants in the simulator to communicate with the CGF entities in as natural a fashion as possible. One area of focus was to investigate methods by which geographic locations within the VE could be designated using voice alone. One technique that proved effective was the use of a renaming table to provide multiple natural language references to geographical points within DISAF. A further technique that proved effective was to allow movement relative to points using eight cardinal compass points as directions. Using this technique, commands such as "Move east" or "Move east of me" or "Move 100 meters north of the hotel" could be used. The most useful movement command was the "Follow me" command. Using this command, a unit leader simply had to achieve one successful vocalization and his subordinates would follow for any length of time regardless of the complexity of the route.

Omni-Directional Treadmill

The development of the ODT continued through FY 01, when the ODT participated in the FY 01 Culminating Event. The ODT was not a part of the FY 02 CE, but was instead incorporated into the Tactical Engagement Simulation Facility at Aberdeen Proving Ground, Maryland. A second-generation ODT is planned.

The Culminating Event Network

The network configuration for the CE is shown in Figure 7. The following items were connected to the network:

- Six SVS individual soldier simulators. These were used by the squad leader, the two fire team leaders, and the three Fire Team A members. The simulators were identical, except for additional equipment in the Fire Team B leader's area for the voice recognition system. All SVSs were equipped with ASTi™ radio headsets, which

permitted verbal communication on up to two channels, depending on the duty position. The squad leader could talk to his fire team leaders and the platoon leader (a role player). Each fire team leader could talk to the squad leader and his subordinates. Fire team members could talk among themselves and with their fire team leader.

- One Voice Recognition PC
- Two DIVAARS Systems (2 PCs each)
- One Dynamic Terrain Server
- One BattleMaster/DISAF Operator Station. The DISAF Operator and the Exercise Controller used this station.
- One Desktop SVS used by a role player

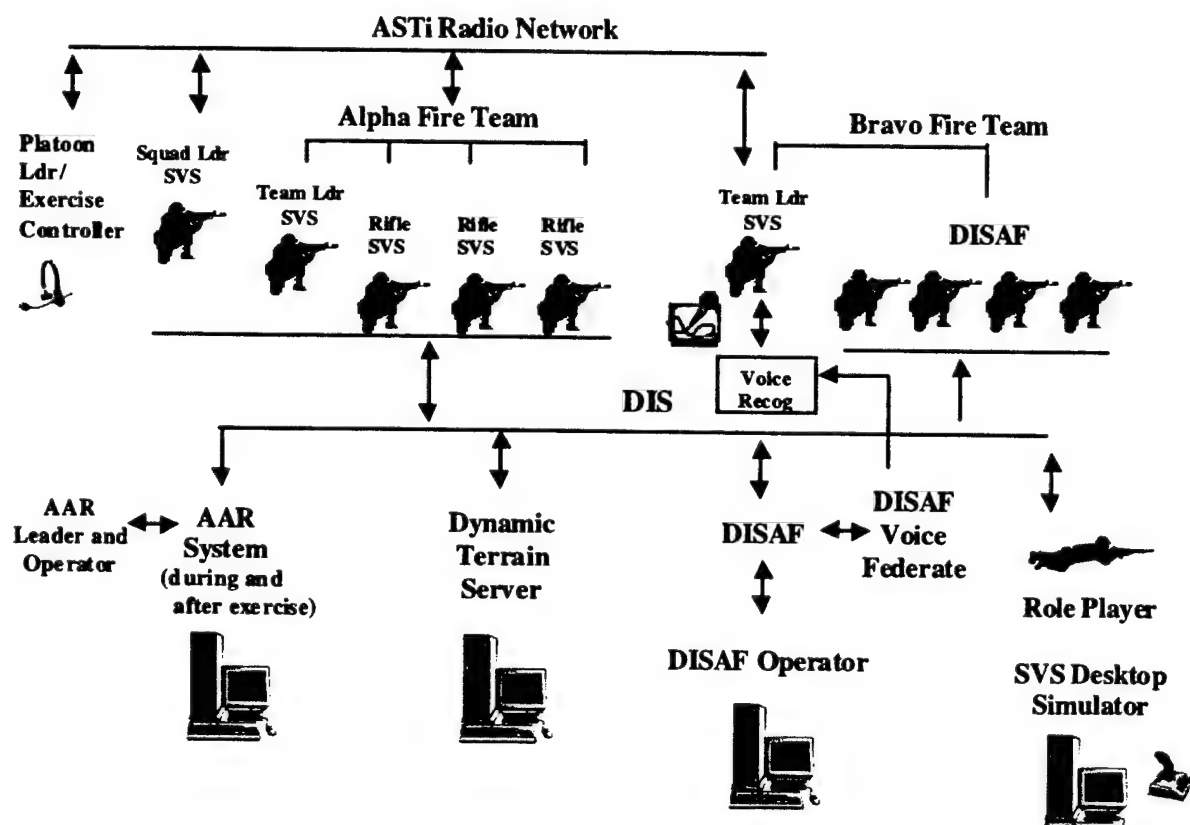


Figure 7. CE system configuration.

Scenarios

A description of the general situation and nine different scenarios were developed for the CE. The general situation, in the form of a "Press Release", was provided to each new group of soldiers (exercise participants) before they began their training. This helped to provide a background overview as to why they were executing the various scenarios. The general situation is described in the paragraphs below and a map of the fictional town is at Figure 8.

Associated Press
Dlubac, El Polksa

The U.N. Protection Force continues to closely monitor conditions in the town of Dlubac located in the providence of El Polksa. Rebel forces from the radical nationalist group Black Sabbath have been linked to several terrorist bombings and attacks on the nearby towns. The strategic importance of Dlubac, overlooking one of the major routes entering El Polksa, makes this town a prime target for rebel activities. The U.S. 1-11th Infantry Battalion attached to the U.N. Protection Force has been tasked with coordinating U.N. activities within the region.

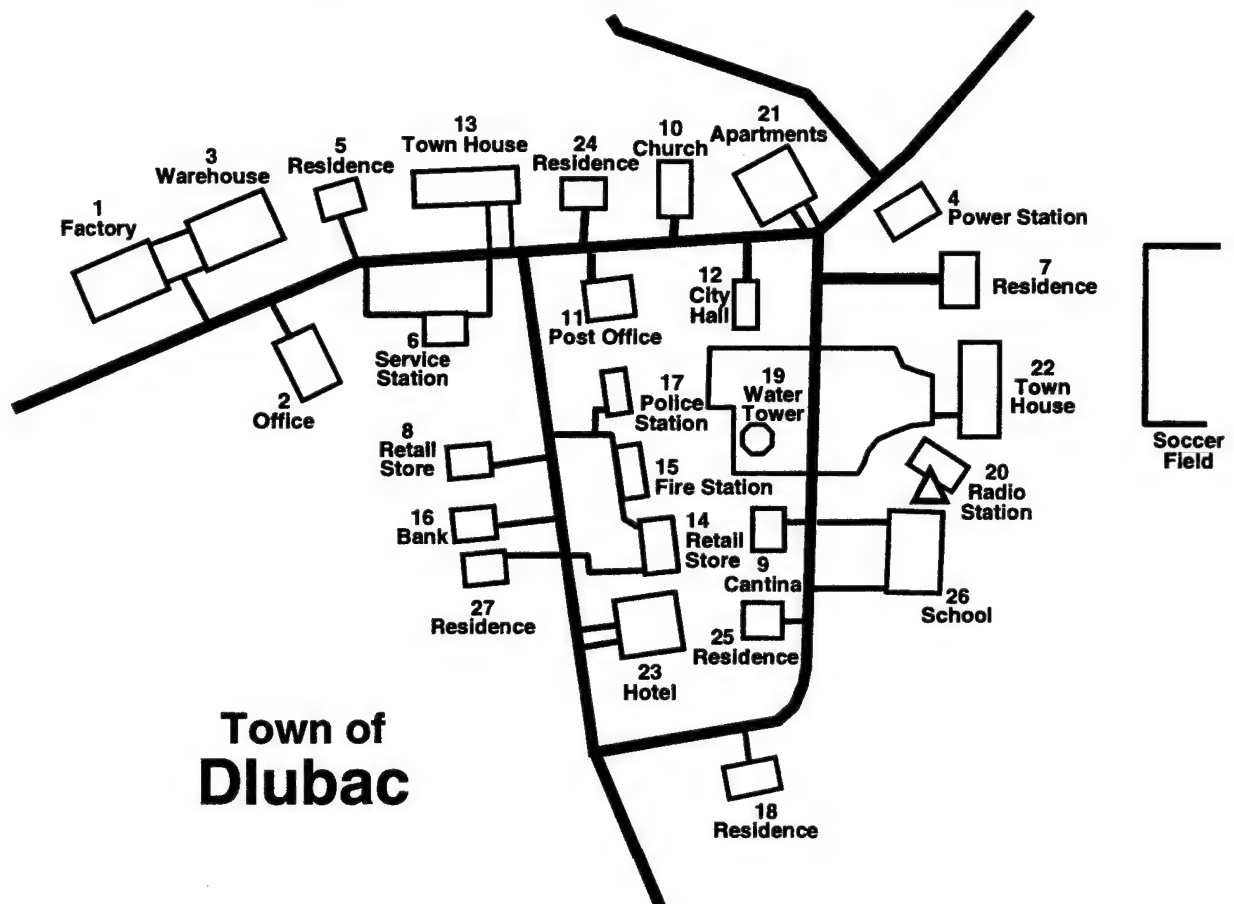


Figure 8. Map of the town of Dlubac.

Each of the scenarios was designed to be 20-30 minutes in duration. They focused specifically on creating the opportunity and need for the soldiers to use the various new devices and capabilities in the VE. Each scenario provided a different mission so the capabilities would be used under differing circumstances. Scenarios were also designed to actively involve as many players as possible. Eight of the nine scenarios took place in the town of Dlubac itself. Dlubac was in fact a virtual representation of the Shughart-Gordon training facility at Fort Polk, Louisiana. The ninth scenario took place in a high-rise office building described as being in an

adjacent town. The scenarios covered a variety of wartime and Support and Sustainment Operations (SASO). The descriptive scenario titles were:

- Roving Patrol
- Hostage Rescue (two scenarios)
- Deliberate Attack (two scenarios)
- Air Assault and Clear a Building
- Assault and Clear a Building
- Crowd Control
- Downed Helicopter

The Roving Patrol scenario was used only for familiarization. Unit performance was not scored on this scenario. The two different versions of the Hostage Rescue (6A and 6B) and Deliberate Attack (7A and 7B) were designed to be comparable in terms of mission type and difficulty, although the starting points and objectives were different. Complete scenario descriptions are in Appendix B.

Questionnaires and Performance Measurement

The questionnaires used are briefly described below. All questionnaires are in Appendix C.

The *Demographic Questionnaire* contains 18 questions about the soldier's military career, training, personal characteristics, and experience with simulators.

The *SAF Performance Questionnaire* contains 17 items comparing the performance of SAF with that of real soldiers. Response alternatives are *Much Worse than Soldiers*, *Slightly Worse than Soldiers*, *About the Same as Soldiers*, *Slightly Better than Soldiers*, and *Much Better than Soldiers*.

The *Simulator Capability Questionnaire* is a multi-part questionnaire covering a variety of topics. One set of 54 items asked soldiers to rate their ability to perform various tasks in the simulators (*Very Good*, *Good*, *Poor*, *Very Poor*). The balance of the questionnaire items were rated on a five-point scale of *Strongly Agree* to *Strongly Disagree* and covered dynamic terrain (7 items), SVS enhancements (6 items), and the AAR system (8 items).

The *Training Effectiveness Questionnaire* contains 11 items asking how much improvement in task performance resulted from the day's exercises (*No Improvement*, *Slight Improvement*, *Moderate Improvement*, or *Vast Improvement*).

The *Voice Recognition Questionnaire* contains nine items on the use of the voice recognition system, seven rated on a five-point scale of *Strongly Agree* to *Strongly Disagree*, and two items asking for percentages.

The *Symptom Checklist* is a list of symptoms used to assess simulator sickness. It is a modified version of a checklist developed by Kennedy et al. (1993). Each of 16 symptoms is rated as *None*, *Slight*, *Moderate*, or *Severe*. The modification was the replacement of the single symptom "sweating" with "cold sweating" and "warm sweating."

A *Structured Interview* was used to obtain additional information. All leaders and soldiers participated in a structured interview on the last day after the questionnaires had been completed. Leaders and soldiers were interviewed in separate groups.

The *CE Unit Evaluation Checklist* was used to assess the performance of each unit during the conduct of each scenario. Three evaluators (the Instructor/Controller, the AAR Leader, and the live OPFOR), rated the unit on 14 items at the conclusion of each scenario except the initial, familiarization scenario (Roving Patrol). The checklist consisted of 14 items that were rated on a five-point scale. The scale anchor points corresponded to the percentage of the time that the unit demonstrated the behaviors described in the items. Behaviors demonstrated less than 20% of the time were given a rating of 1, 20-40% a rating of 2, 41-60% a rating of 3, 61-80% a rating of 4, and greater than 80% a rating of 5.

Chronology of Soldier Activities

The planned daily schedule for the soldier participants is shown in Appendix D. Upon their arrival at the Virtual Simulation Lab on their first day of participation, the soldiers were given an introductory briefing which described: the overall purpose of the exercises; the nature of the performance and questionnaire data to be collected; the procedures that would be followed to insure the privacy of information collected; safety procedures; and administrative information. The soldiers then completed two questionnaires, the demographic questionnaire and the symptom checklist. They were assigned duty positions for the exercises based on their rank: Squad Leader, Fire Team A Leader, Fire Team B Leader, or Fire Team A Member.

Next all soldiers received approximately one hour of instruction and practice on the use of the SVS. A live instructor provided the training. The major tasks are shown in Table 3.

After the completion of the SVS training, additional training was conducted on two parallel tracks. The Fire Team B Leader received training in the use of the voice recognition and synthesis system to control DISAF. He would use this during the exercises. The Squad Leader and the balance of the squad reviewed urban tactics and procedures, and the general situation for the training scenarios. This completed the morning session.

Table 3
SVS Tasks Trained

| | |
|--|---|
| Postures <ul style="list-style-type: none"> • stand • kneel • crouch • prone | Weapons calibration and use <ul style="list-style-type: none"> • use of menus • button functionality • calibrate • boresight weapon • engage stationary target • engage moving target • engage stationary target while moving • reload • secondary weapon <ul style="list-style-type: none"> • grenades <ul style="list-style-type: none"> • fragmentation • smoke • flashbang • flares <ul style="list-style-type: none"> • hand thrown • launched • C4 <ul style="list-style-type: none"> • sizes • emplacement |
| Basic locomotion (open terrain) <ul style="list-style-type: none"> • walk • run • crawl • crouch-walk Advanced locomotion (urban areas) <ul style="list-style-type: none"> • doors • windows • stairs • rubble • stacking • furniture and other obstacles | |
| Change view/orientation while in position | Auditory weapons recognition |
| Visual Effects <ul style="list-style-type: none"> • night • lighting <ul style="list-style-type: none"> • streetlights • interior lights • flashlights • shooting out lighting • shooting out transformers • tracer fire • fragmentation grenades • flashbang grenades • smoke grenades | Visual recognition <ul style="list-style-type: none"> • friendly • enemy • civilians • armed civilians • other humans used in the scenarios (e.g., police) • vehicles • furniture • dynamic terrain <ul style="list-style-type: none"> • building dings • breach holes • rubble • dead vs. wounded prone visual difference |
| Binoculars <ul style="list-style-type: none"> • scanning • zooming | Wounding <ul style="list-style-type: none"> • visual cues • health icon • performance effects |

In the afternoon the soldiers completed three exercises: one familiarization exercise and two training exercises. Each exercise session consisted of a verbal delivery of the mission order by the Instructor/Controller, supplemented with a map of the town (Figure 7) and a static 3-D image of the town displayed by DIVAARS. The Squad Leader then developed his mission plan and briefed the squad. Soldiers next moved to their simulators and calibrated their weapons. The exercise was conducted. Soldiers were then given a break. They next reported to the DIVAARS station where the AAR Leader conducted an AAR. Following the AAR, the cycle started over again with the delivery of the next mission order by the Instructor/Controller. At the end of the first day, all soldiers completed the symptom checklist, and the Squad and Fire Team Leaders completed the Training Effectiveness Questionnaire.

Because some technical problems were not discovered until the first execution of the scenarios with the squads of soldiers, the scenarios for Squad 1 were not executed as planned. Squad 1 completed only two scenarios on Day 1, and while they did complete five scenarios on Day 2, they were not in the intended order. Table 4 shows the actual sequence of events for each of the three squads, along with the actual duration of each scenario. The times required for the different activities on the schedule varied from day to day, so the times shown in Appendix D were not strictly adhered to. With these exceptions, however, exercise events were generally carried out as planned.

Table 4
Scenario Sequence and Duration for each Squad

| Scenario Sequence | | | | | |
|---------------------------------|------------|--------------|------------|--------------|------------|
| Squad 1 | | Squad 2 | | Squad 3 | |
| Day 1 | Day 2 | Day 1 | Day 2 | Day 1 | Day 2 |
| Morning | | | | | |
| Introduction | 13 (11:55) | Introduction | 13 (09:44) | Introduction | 13 (08:00) |
| Training | 11 (28:50) | Training | 10 (12:57) | Training | 10 (12:37) |
| Practice | | Practice | 11 (25:42) | Practice | 11 (22:24) |
| Afternoon | | | | | |
| 6A (32:35) | 6B (18:24) | 6B (18:45) | 6A (18:50) | 6A (12:13) | 6B (18:52) |
| 7A (28:27) | 7B (38:40) | 7B (32:59) | 7A (23:07) | 7A (04:10) | 7B (25:34) |
| | 10 (13:40) | 14 (16:29) | | 14 (23:46) | |
| Total Daily Scenarios Completed | | | | | |
| 2 | 5 | 3 | 5 | 3 | 5 |
| Total Scenarios Completed | | | | | |
| 7 | | 8 | | 8 | |

Results

Soldier Characteristics

The participating squads were composed of Cavalry Scout soldiers (MOS 19D) from the scout platoon of a mechanized Infantry battalion. Scouts conduct mounted and dismounted patrols both individually and in small teams to provide combat intelligence on terrain data and enemy strength, disposition, and equipment. Their organization is normally by crew and section rather than the 9-man Infantry squad, the organizational concept around which CE scenarios were developed. Three composite squads were organized to support the CE. Prior MOUT training, including Joint Readiness Training Center (JRTC) rotations, was limited to traditional Scout duties of external security around the MOUT site. Thus while the soldiers were acquainted with each other, they had not previously functioned as a dismounted Infantry squad organized as they were during these exercises.

The participants in the exercises were 20⁴ Infantry soldiers in MOSs 19D, and in pay grades E-4 (13 soldiers), E-5 (4), and E-6 (3). Their average age was 24 years. They had a mean time of 48 months in the Army, and 13 months in their current duty position. Of the 20, 15 were right-handed, 19 had normal color vision, and 17 reported 20/20 vision (natural or corrected). Nineteen of the soldiers had completed Infantry Advanced Individual Training or One-Station Unit Training, seven had completed the Primary Leader Development Course, two had completed the Basic NCO Course, and 20 had completed the Combat Lifesaver Course. Two soldiers had prior experience with the SVSs.

Unit Performance Data

As described, three raters completed the Unit Performance Checklist independently for each squad on each scenario. Scores for the individual items were averaged to obtain an overall performance score for each scenario for each rater. These were in turn averaged to produce a single score for each squad for each scenario. The mean rater intercorrelation was .70, indicating fairly good agreement among the raters. Mean scores for each squad for each scenario are shown in Table 5.

Table 5
Mean Performance Scores by Squad and Scenario

| Scenario Number | 6A | 6B | 7A | 7B | 10 | 11 | 13 | 14 | Mean |
|-----------------|------|------|------|------|------|------|------|------|------|
| Squad #1 | 3.19 | 3.34 | 1.89 | 4.06 | 3.63 | 2.54 | 2.11 | .* | 2.96 |
| Squad #2 | 4.47 | 3.98 | 2.94 | 4.32 | 4.91 | 4.99 | 4.80 | 4.59 | 4.38 |
| Squad #3 | 3.73 | 4.87 | 3.69 | 3.90 | 3.98 | 4.82 | 3.44 | 4.26 | 4.09 |
| Mean Score | 3.80 | 4.06 | 2.84 | 4.09 | 4.17 | 4.12 | 3.45 | 4.43 | |

Note. Squad 1 did not complete scenario 14.

⁴ Because of other duty commitments and illness, 20 different soldiers filled the 18 positions (three groups of six soldiers each) in the experiment. The Squad Leader and the Alpha Fire Team Leader were always the same for each group.

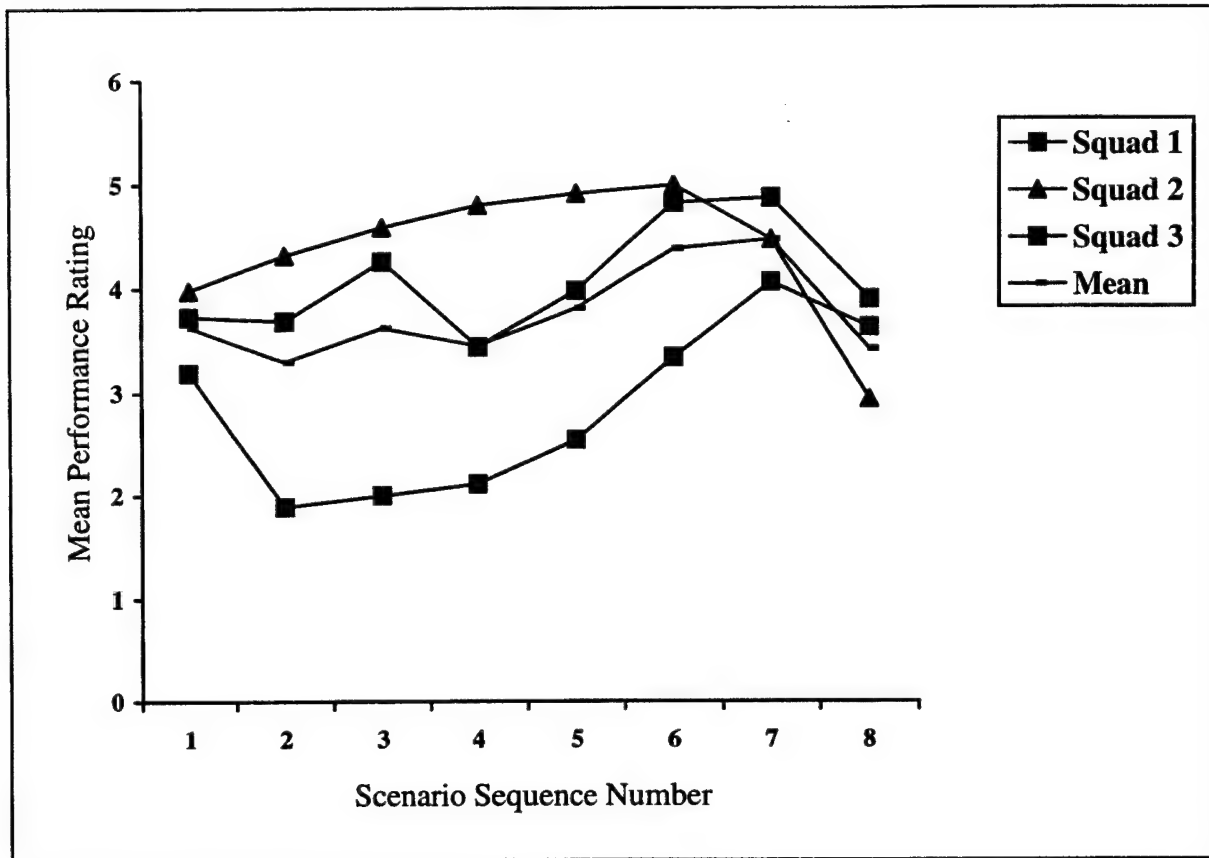


Figure 9. Performance ratings as a function of scenario number.

The primary question of interest is whether performance improved with practice. This can be examined in two ways. First, by looking at the overall performance trends over time, and second, by comparing performance on those pairs of scenarios which were intended to be comparable (6A and 6B, 7A and 7B).

The overall trend is shown in Figure 9. In order to smooth the curves, Squad 1 was assigned a score for their third scenario (which they did not receive) equal to the mean of their second and fourth scenarios. The most obvious trend is a sharp decline in performance on the final scenario of the second day. This occurs for every squad. Since each squad had different scenarios in both the seventh and eighth positions in their sequence, it is unlikely to result from a more difficult final scenario. Fatigue or a "going home" letdown are the most likely causes.

Table 6 shows the means for the first and second occurrences of the comparable scenarios. Overall, the squads received a mean score of 3.47 on the first occurrence of a scenario, and 3.72 on the later occurrence of a comparable scenario. Of the six possible comparisons (three squads times two pairs of scenarios), five showed better performance on the second occurrence.

Table 6
Comparison of Performance on Comparable Scenarios

| Scenario Number | Scenario Order | Squad | | | Mean |
|-----------------|----------------|-------|------|------|------|
| | | 1 | 2 | 3 | |
| 6 | 1 | 3.19 | 3.98 | 3.73 | 3.63 |
| | 2 | 3.34 | 4.47 | 4.87 | 4.23 |
| 7 | 1 | 1.89 | 4.32 | 3.69 | 3.30 |
| | 2 | 4.06 | 2.94 | 3.90 | 3.63 |
| Mean | 1 | 2.54 | 4.15 | 3.71 | 3.47 |
| | 2 | 3.70 | 3.71 | 4.39 | 3.72 |

A number of other analyses were conducted using the evaluation checklist data to examine other issues related to squad performance. These included alternate scoring schemes, and examination of time of day and scenario difficulty effects. Because of the small number of squads involved, differences in squad proficiency, and the identical order of the scenarios for all squads (except for 6 A and B and 7 A and B), it was not possible to identify any other meaningful trends.

Questionnaire Data

Simulator Capabilities

All soldiers completed the Simulator Capability Questionnaire. Mean scores were calculated for each item by assigning a response of *Very Poor* a value of 0, *Poor* a value of 1, *Good* a value of 2, and *Very Good* a value of 3. Table 7 provides a comparison of the soldier and leader simulator capability ratings across three of the four years of the STO (1999, 2001, and 2002). The then-current version of the SVS was used in each of those years, but not in 2000. Not all soldiers responded to every question. The questionnaire items are listed in order of descending FY 02 mean value. The most noticeable result is a fairly consistent pattern of higher ratings in 2002 than in 2001 and, to a lesser extent, 1999. The overall mean of the common items was 1.90 in 1999, 1.74 in 2001 and 2.12 in 2002. Exceptions to this trend of higher ratings tended to be in the areas of identification of enemy and civilians, precise movement, and discrimination of auditory cues. In 2002 the armed civilian, who looked like a civilian but acted like an enemy, was introduced into the scenarios, and may have been the reason why soldiers had more difficulty identifying who was an enemy and who was a civilian.

Thirty-six of 52 tasks were rated *Good* or higher (mean equal to or greater than 2.0) in 2002, as compared with 16 in 1999 and 14 in 2001. The more highly rated tasks consisted of identification of types of people (such as civilians and non-combatants) and tactically significant areas, imprecise movement, and communication. The lower rated tasks consisted of precise or rapid movement, including aiming, distance estimation, and locating the source of enemy fire using either visual or auditory cues. Mean task ratings for 2001 and 2002 were compared using *t* tests. Overall, 22 means differed significantly at $p < .05$, with the higher mean always being 2002. Since information about the variability of responses to the 1999 questionnaire was no

longer available, 95% confidence intervals around the 2002 task means were calculated, and these were compared with the 1999 means. Twenty-one of the 1999 means fell outside the confidence intervals of the 2002 means. Twenty were lower than the 2002 mean, and one was higher.

AAR System

All soldiers rated the DIVAARS on eight items, shown in Table 8. This table also shows the percentage of the soldiers who agreed or strongly agreed with those eight positively-worded statements about the effectiveness of DIVAARS in both 2001 and 2002. In examining these results it should be noted that the ratings likely reflect the combined performance of the AAR Leader and DIVAARS. DIVAARS was a tool the AAR Leader used to analyze problems with the unit execution, determine the causes of problems, and then facilitate participant dialogue. The ratings are overall very high, with at least 94% of the soldiers agreeing or strongly agreeing with every item. (Recall that the purpose of an AAR is to help the soldiers develop a better understanding of what happened and why it happened, so that they can learn how to do better.) Ninety-four percent of the soldiers agreed or strongly agreed that the AAR system made clear what happened during a mission, 100% agreed or strongly agreed that it made clear why things happened the way they did during a mission, and 95% agreed or strongly agreed that it made clear how to do better in accomplishing the mission.

The lowest rated item in 2001, effectiveness in replaying communications, showed substantial improvement, from 56% agreeing or strongly agreeing to 94%. This is consistent with the observed improvement in intelligibility of the communications. While the increase in the percentage of overall positive responses for the other items was not as great, the increases in the percentage of soldiers who strongly agreed was substantial, ranging from 32% to 54%, and averaging 44%.

Table 7
Simulator Capability Questionnaire Responses

| Task | VE STO 1999 Mean* | VE STO 2001 | | VE STO 2002 | |
|---|----------------------------|----------------|----|----------------|----|
| | | Mean | N | Mean | N |
| Execute planned route. | 1.89* | 2.06* | 18 | 2.67 | 18 |
| Use hand-held illumination (flares). | | | | 2.59 | 17 |
| Employ tactical hand-held smoke grenades. | | | | 2.56 | 18 |
| Identify assigned sectors of observation. | 2.06* | 1.94* | 17 | 2.53 | 17 |
| Move in single file. | 2.00* | 1.94* | 18 | 2.50 | 18 |
| Look around corners. | 1.47* | 1.29* | 17 | 2.50 | 18 |
| Communicate enemy location to team member. | 2.06* | 1.89* | 18 | 2.50 | 18 |
| Move through open areas as a widely separated group. | 2.38 | 2.33 | 18 | 2.47 | 17 |
| Understand verbal commands. | 1.94* | 2.29 | 18 | 2.47 | 18 |
| Fire weapon in short bursts. | 2.00* | 1.89* | 18 | 2.44 | 18 |
| Move quickly to the point of attack. | 1.94* | 1.89* | 18 | 2.44 | 18 |
| Communicate spot reports to squad leader. | 1.94* | 2.00* | 18 | 2.44 | 18 |
| Scan from side to side. | 1.72* | 1.94* | 18 | 2.44 | 18 |
| Use flash-bang grenades to help clear rooms. | | | | 2.44 | 18 |
| Identify sector of responsibility. | 2.11* | 2.17 | 17 | 2.39 | 18 |
| Move according to directions. | 2.17 | 2.29 | 17 | 2.33 | 17 |
| Locate assigned areas of observation, e.g. across the street. | 2.17 | 1.88 | 17 | 2.33 | 18 |
| Identify civilians. | 2.72* | 2.22 | 18 | 2.33 | 18 |
| Coordinate with other squad members. | 1.88* | 2.00 | 18 | 2.33 | 18 |
| Execute the assault as planned. | 1.89* | 1.83* | 18 | 2.33 | 18 |
| Locate support team positions. | 2.00* | 1.72* | 18 | 2.33 | 18 |
| Use fragmentation grenades. | | | | 2.29 | 17 |
| Identify covered and concealed routes. | 1.94* | 1.94* | 18 | 2.28 | 18 |
| Identify safe and danger areas. | 2.22 | 2.11* | 18 | 2.28 | 18 |
| Maneuver below windows. | 2.06 | 1.61* | 18 | 2.22 | 18 |
| Assume defensive positions. | 2.06 | 2.00 | 18 | 2.22 | 18 |
| Locate buddy team firing positions. | 1.94 | 1.78* | 18 | 2.22 | 18 |
| Engage targets within a room. | 2.06 | 1.61* | 18 | 2.22 | 18 |
| Identify enemy soldiers. | 2.44 | 1.53* | 17 | 2.22 | 18 |
| Identify areas that mask supporting fires. | 1.72* | 2.00 | 18 | 2.17 | 18 |
| Identify non-combatants within a room. | 2.24 | 2.06 | 18 | 2.17 | 18 |
| Take hasty defensive positions. | 1.89 | 1.71* | 17 | 2.11 | 18 |
| Aim weapon. | 2.28 | 1.71 | 17 | 2.11 | 18 |

Note. A blank in a cell indicates that that question was not included in that year. *1999 N=18

* significantly different from the 2002 mean at $p < .05$.

Table 7. (continued)
Simulator Capability Questionnaire Responses

| Task | VE STO 1999 Mean | VE STO 2001 | | VE STO 2002 | |
|---|---------------------------|----------------|----|----------------|----|
| | | Mean | N | Mean | N |
| Determine other team members' positions. | 1.78* | 2.00 | 18 | 2.06 | 17 |
| Scan the room quickly for hostile combatants. | 1.76 | 1.29* | 17 | 2.06 | 17 |
| Maintain position relative to other team members. | 1.78* | 2.06 | 18 | 2.06 | 18 |
| Take position to one side of a doorway. | 2.11 | 1.94 | 18 | 2.06 | 18 |
| Maneuver around corners. | 1.67* | 1.06* | 18 | 2.00 | 18 |
| Maneuver around obstacles. | 1.67* | 1.39* | 18 | 1.94 | 18 |
| Estimate distances from self to a distant object. | 1.72 | 1.22* | 18 | 1.89 | 18 |
| Locate enemy soldiers inside buildings firing at your unit. | | 1.71 | 17 | 1.88 | 18 |
| Move close to walls. | 1.56 | 1.41 | 17 | 1.83 | 18 |
| Maneuver close to others. | 1.65 | 1.50 | 18 | 1.78 | 18 |
| Fire weapon accurately. | 1.78 | 1.35 | 17 | 1.78 | 18 |
| Climb up or down ladders. | | 1.92 | 12 | | |
| Take a tactical position within a room. | 1.83 | 1.72 | 18 | 1.72 | 18 |
| Determine the direction enemy rounds are coming from. | | 1.06 | 18 | 1.72 | 17 |
| Climb up or down stairs. | | 1.55 | 17 | 1.82 | 18 |
| Move quickly through doorways. | 1.61 | 1.50 | 18 | 1.67 | 18 |
| Maneuver past other personnel within a room. | 1.55 | 1.33 | 18 | 1.61 | 18 |
| Visually locate the source of enemy fire. | 1.44 | 0.83 | 18 | 1.59 | 17 |
| Move past furniture in a room. | 1.56 | 1.86 | 14 | 1.59 | 17 |
| Determine the source of enemy fire by sound. | 1.78 | 1.06 | 18 | 1.44 | 18 |
| Distinguish between friendly and enemy fire. | 1.61 | 1.28 | 18 | 1.44 | 18 |
| Scan vertically. | 1.11 | 1.12 | 17 | 1.39 | 18 |
| Mean (common items) | 1.90 | 1.75 | | 2.12 | |

Notes: 1999 N=18. A blank in a cell indicates that that question was not included in that year.

* significantly different from the 2002 mean at $p<.05$.

Table 8
AAR System Ratings

| The AAR system | Rating | 2001 (N=18) | 2002 (N=17) |
|---|----------------|----------------|----------------|
| ...was effective in displaying movement outside of buildings | Strongly Agree | 28% | 82% |
| | Agree | 61% | 18% |
| | Total | 89% | 100% |
| ...was effective in displaying movement inside of buildings | Strongly Agree | 33% | 82% |
| | Agree | 50% | 18% |
| | Total | 83% | 100% |
| ...was effective in replaying communications | Strongly Agree | 28% | 82% |
| | Agree | 28% | 12% |
| | Total | 56% | 94% |
| ...made clear what happened during a mission | Strongly Agree | 44% | 82% |
| | Agree | 56% | 12% |
| | Total | 100% | 94% |
| ...made clear why things happened the way they did during a mission | Strongly Agree | 44% | 76% |
| | Agree | 39% | 24% |
| | Total | 83% | 100% |
| ...made clear how to do better in accomplishing the mission | Strongly Agree | 28% | 71% |
| | Agree | 56% | 24% |
| | Total | 84% | 95% |
| ...made clear the order in which key events occurred during the mission | Strongly Agree | 33% | 82% |
| | Agree | 67% | 12% |
| | Total | 100% | 94% |
| ...was more effective than conducting an AAR without any visual or auditory playback (just talking) | Strongly Agree | 50% | 94% |
| | Agree | 33% | 6% |
| | Total | 83% | 100% |

DISAF Performance

The Squad Leaders and Fire Team Leaders rated DISAF performance. Mean ratings were calculated by assigning *Much Better than Soldiers* a value of +2, *Slightly Better than Soldiers* a value of +1, *About the Same as Soldiers* a value of 0, *Slightly Worse than Soldiers* a value of -1, and *Much Worse than Soldiers* a value -2. Results are shown in Table 9. An average rating of 0 indicated that the DISAF were about the same as real soldiers, while a +1 indicated they were slightly better, and -1, slightly worse. Ratings in 2002 improved relative to 1999 and 2001. DISAF can locate/identify the enemy better than real soldiers, but have trouble moving to and firing at the correct locations, and reporting their observations or activities to their Fire Team Leader. Generally, those activities rated lower in 2002 than in 1999 were activities, primarily control of movement, that were performed by the DISAF operator in 1999 and via voice control in 2002. Thus while the introduction of voice control may have reduced the workload of the DISAF operator, it was not necessarily an improvement from the leader perspective.

Table 9
Mean DISAF Behavior Ratings

| SAF Behavior | 1999 (N=9) | 2001 | 2002 (N=9) |
|--|---------------|-------|---------------|
| Distinguish between friendly and enemy positions. | -0.90 | 0.22 | 0.89 |
| Locate known or suspected enemy positions. | -1.10 | -0.22 | 0.67 |
| Clear a room. | -1.44 | -0.44 | 0.56 |
| Fire weapons accurately. | -0.40 | -0.43 | 0.22 |
| Clear a building. | -1.33 | -0.38 | 0.11 |
| React to contact. | -1.00 | -0.89 | 0.00 |
| React to ambush. | -0.88 | -1.11 | -0.22 |
| Move through open areas. | -1.00 | -1.00 | -0.67 |
| Take hasty defensive positions. | -0.50 | -1.11 | -0.67 |
| Maintain position relative to other squad or team members. | -0.50 | -1.29 | -0.67 |
| Deliver suppressive fire. | -0.80 | -0.88 | -0.78 |
| Support by fire. | -0.67 | -1.38 | -0.78 |
| Move through built-up areas. | -0.67 | -1.00 | -0.89 |
| Move to designated location. | -0.10 | -0.13 | -1.11 |
| Perform fire and movement. | -0.67 | -1.00 | -1.25 |
| Communicate information to squad leader. | -0.80 | -1.11 | -1.38 |
| Change formation. | -0.62 | -1.25 | -1.56 |
| Mean | -0.79 | -0.79 | -0.44 |

Note. 2001 N varies from 7 to 9.

Dynamic Terrain

All soldiers rated dynamic terrain. Results are shown in Table 10. Ratings of dynamic terrain characteristics were generally lower in 2002 than in 2001. This may have resulted from the fact that in 2002 soldiers were able to make much more frequent and less constrained use of explosives, sometimes with unintended results. See the discussion section for more details.

Table 10
Dynamic Terrain Ratings

| Question | % Agree or Strongly Agree | |
|---|---------------------------|------|
| | 2001 | 2002 |
| Battlefield environment (wrecked vehicles, building damage, civilians and vehicles moving about, etc.) was realistically portrayed. | 92% | 62% |
| The blowhole (C4 or AT-8 fire) created a hole exactly where it was to be placed. | 85% | 47% |
| The sound simulation of the blowhole "burst" (C4 or AT-8 fire) was realistic. | 77% | 71% |
| The effect created by the blowhole (C4 or AT-8 fire) is realistic. | 69% | 41% |
| The flash simulation of the blowhole "bursts" (C4 or AT-8 fire) was realistic. | 50% | 69% |
| The rubble effect realistically portrays that found in a MOUT environment. | 46% | 47% |
| I was able to distinguish rubble from a distance. | 31% | 42% |

Note. N = 18.

SVS Enhancements

The soldiers believed that time was accurately portrayed by the amount of light in the simulator (94.4% agree or strongly agree), street lights were realistic (94.1%), and that shooting out street lights to reduce their impact on the mission was realistic (88.9%). They were less strong in their belief that night conditions were accurately portrayed in the simulator (77.8%) and that building interior lights were realistic (82.4%). They were least convinced that shooting out interior building lights to reduce their impact on the mission was realistic (41.2% agree or strongly agree, while 52.9% neither agreed nor disagreed).

Training Effectiveness

Generally, Squad and Fire Team Leaders said that their performance improved as a result of the training. The percentage who said that their performance improved at least slightly ranged from 82% for the task "Clear a building" to 100% for "Assess the tactical situation," "Control your squad or fire team," and "Plan a tactical operation." Ratings were generally better, and in only one case worse, than those given to the same tasks in the FY 2001 CE. Complete results are shown in Table 11. In general, ratings for coordination, communication, and control tasks were higher than those for specific unit tasks or battle drills, although this difference was not as pronounced in FY 2002 as it had been in previous years. It should be noted that the ratings of training effectiveness are dependent on both the contributions of the human components of the system and the technology components. The characteristics of the scenarios and the performance of the O/C, role players, the DISAF Operator, and the AAR Leader are critical to effective training.

Table 11

Squad and Fire Team Leader Training Effectiveness Ratings

| Task | % Indicating Improvement | | |
|--|--------------------------|------|------------------|
| | 1999 | 2001 | 2002 |
| N | 9 | 15 | 18 |
| Assess the tactical situation. | 67% | 93% | 100% |
| Control your squad or fire team. | 67% | 80% | 100% |
| Plan a tactical operation. | 33% | 73% | 100% |
| Squad/fire team communication and coordination. | 78% | 80% | 94% |
| Control squad or fire team movement during assault. | 67% | 80% | 89% |
| React to Contact Battle Drill. | 44% | 80% | 89% |
| Locate known or suspected enemy positions. | 44% | 67% | 89% |
| Coordinate activities with your chain of command. | 44% | 100% | 88% |
| Control squad or fire team movement while not in contact with the enemy. | 67% | 80% | 83% |
| Clear a room. | 44% | 53% | 83% |
| Clear a building. | 56% | 57% | 82% ^a |

Note. Squad and Fire Team Leaders who participated for two days completed the questionnaire at the end of each day.

^aN = 17

Voice Control of DISAF

Three Fire Team Leaders used voice to control DISAF during the event. They completed the DISAF Voice questionnaire. The results are shown in Table 12.

Table 12
DISAF Voice Recognition Questionnaire Results

| Question | Year | Strongly Agree | Agree | Neither Agree nor Disagree | Disagree | Strongly Disagree |
|--|------|----------------|--------|----------------------------|----------|-------------------|
| It was easy to give voice commands that SAF could understand. | 2001 | 0 | 1 | 0 | 2 | 1 |
| | 2002 | 0 | 2 | 0 | 1 | 0 |
| It was easy to learn to give voice commands to SAF. | 2001 | 0 | 2 | 2 | 0 | 0 |
| | 2002 | 0 | 3 | 0 | 0 | 0 |
| It was easy to tell if the SAF recognized or understood my voice commands. | 2001 | 0 | 4 | 0 | 0 | 0 |
| | 2002 | 0 | 3 | 0 | 0 | 0 |
| Giving voice commands to SAF came naturally. | 2001 | 0 | 2 | 1 | 1 | 0 |
| | 2002 | 0 | 3 | 0 | 0 | 0 |
| I frequently gave voice commands that the SAF did not recognize. | 2001 | 2 | 2 | 0 | 0 | 0 |
| | 2002 | 0 | 2 | 0 | 1 | 0 |
| The SAF responded to my verbal commands. | 2001 | 0 | 3 | 0 | 0 | 1 |
| | 2002 | 0 | 3 | 0 | 0 | 0 |
| The verbal responses were appropriate for the various situations. | 2001 | 0 | 1 | 1 | 0 | 2 |
| | 2002 | 0 | 2 | 1 | 0 | 0 |
| | | < 20% | 20-39% | 40-60% | 61-80% | >80% |
| What percentage of time was SAF unable to recognize your voice commands correctly on the first try? (Respondents selected one of the ranges of percentages shown above.) | 2001 | 1 | 0 | 0 | 1 | 2 |
| | 2002 | 2 | 1 | 0 | 0 | 0 |
| What percentage of time did SAF respond incorrectly to your voice commands? (Respondents selected one of the ranges of percentages shown above.) | 2001 | 3 | 0 | 1 | 0 | 0 |
| | 2002 | 2 | 1 | 0 | 0 | 0 |

Note. FY 2001 N = 4. FY 2002 N = 3.

Given the small number of soldiers responding in either year, there is not much that can be said about these data. However, it is clear from the responses to question 8 that speech recognition accuracy was substantially better in 2002 than the previous year.

Simulator Sickness

Responses to the symptom checklist are summarized in Table 13. A mean symptom score was calculated by assigning each response of *None* a value of 0, *Slight* a value of 1, *Moderate* a value of 2, and *Severe* a value of 3. Average total score was 1.16 prior to the first use of the simulators, and 1.36 at the end of the day. This equates to slightly more than one "slight" symptom per soldier. The most frequently reported symptoms at the end of the day were fatigue headache, and eyestrain. Headache and eyestrain also showed the greatest increase from morning to afternoon, although the increases were slight. Some symptoms (cold sweating, dizziness eyes open, dizziness eyes closed, and vertigo) were never reported.

Table 13
Symptoms Reported

| Symptom | All Sessions Mean (N = 73) | Morning Sessions Mean (N = 37) | Afternoon Sessions Mean (N = 36) | Change (Afternoon - Morning) |
|--------------------------|----------------------------|--------------------------------|----------------------------------|------------------------------|
| Fatigue | 0.42 | 0.38 | 0.47 | 0.09 |
| Headache | 0.19 | 0.11 | 0.28 | 0.17 |
| Eye Strain | 0.19 | 0.11 | 0.28 | 0.17 |
| General Discomfort | 0.12 | 0.16 | 0.08 | -0.08 |
| Difficulty Focusing | 0.10 | 0.11 | 0.08 | -0.02 |
| Salivation Increased | 0.07 | 0.11 | 0.03 | -0.08 |
| Nausea | 0.04 | 0.03 | 0.06 | 0.03 |
| Difficulty Concentrating | 0.04 | 0.05 | 0.03 | -0.03 |
| Stomach Awareness | 0.03 | 0.03 | 0.03 | 0.00 |
| Warm Sweating | 0.01 | 0.03 | 0.00 | -0.03 |
| "Fullness of Head" | 0.01 | 0.03 | 0.00 | -0.03 |
| Blurred Vision | 0.01 | 0.00 | 0.03 | 0.03 |
| Burping | 0.01 | 0.03 | 0.00 | -0.03 |
| Cold Sweating | 0.00 | 0.00 | 0.00 | 0.00 |
| Dizziness eyes Opened | 0.00 | 0.00 | 0.00 | 0.00 |
| Dizziness eyes Closed | 0.00 | 0.00 | 0.00 | 0.00 |
| Vertigo | 0.00 | 0.00 | 0.00 | 0.00 |
| TOTALS | 1.26 | 1.16 | 1.36 | 0.20 |

Note. Totals do not equal the sums of the individual cell entries because of rounding.

Lessons Learned

In general, the individual systems performed well during the CE. Although problems were encountered at the individual system level, it was possible to correct the major ones on the spot. This section is not intended to provide a list of problems encountered and fixed (or not). It is intended to provide general lessons learned about the conduct of the CE and qualitative observations about system, participant, and trainee soldier performance.

Systems Integration

Problems stemming from the integration of the systems were usually more difficult to diagnose and correct than problems with individual systems. While integration testing was conducted in Orlando about one month prior to the CE, this testing could not include the same number of SVSs as were used in the final CE, nor could it include all of the CE scenarios. Given this history, it is obvious in retrospect that three days was insufficient time for system set-up, integration, and testing. More time should have been built into the CE schedule for integration and testing, to include testing of all scenarios with a realistic participant load.

Types of system integration problems encountered included heavy network traffic, visual and physical model inconsistencies, and use of system-specific data packets which could not be interpreted by other systems. Network traffic became a problem because while the bandwidth of the Virtual Simulation Lab network was limited, no managerial or technical effort was made to control requirements for bandwidth or to allocate it among the various systems. Requirements for bandwidth across systems should be a consideration in the future.

AAR System

DIVAARS proved to be a highly reliable tool to assist the AAR Leader in data collection, key event monitoring, AAR planning, and AAR presentation. However, events also showed that a skilled AAR Leader was necessary to identify and interpret key events and conduct the AAR effectively.

Some features worked very well. Projecting the image onto a large screen greatly improved visibility and added to the value of the AAR sessions. Preset views of probable critical points or potential vulnerabilities during the mission provided valuable locations to begin observations from as the mission progressed. The captured video, top-down floor views, ability to remove portions of buildings, entity views, and tabular data provided leaders and soldiers with high fidelity observations and data to document their own actions and reactions, as well as actual OPFOR or potential OPFOR perspectives. The jump forward/back, variable speeds, and real-time playback let the leaders and soldiers understand the results of their movements, actions, and inactions. Sound playback further reinforces this understanding. With mission duration varying from seven to thirty minutes, the flexible nature of the system provided the capability to assemble the resources for a solid AAR in five to ten minutes.

However, some problems were encountered. DIVAARS required a dedicated, trained operator. The AAR Leader, who first saw DIVAARS two days before giving his first AAR, never acquired sufficient proficiency in the operator role, and consequently conducted the AARs by giving verbal commands to the operator. More, better-structured, experience probably would have helped, but so would improvements to the interface. While some aspects of the interface, such as changing preprogrammed views, are simple to operate now, other functions need to be refined and simplified. Free flying with the mouse, a frequently required capability, demands extensive skill and practice. Conversion of this capability to a joystick type control could

improve the interface. Creation of a GUI that would permit rapid access of flagged events at optimized views would be another great addition

The current tracking system provides icons sized to display movement and extended dwell time of entities. This capability proved to be extremely helpful during the AAR process; however, the size of the icons should be reduced. Icons should also be displayed by floor in multistory buildings to permit display of movements on a single level.

There are a number of new features that could be added to DIVAARS. The most important would be the incorporation of a commercial graphics package which could be used to generate instructional support materials for the AAR process. Word charts or graphic illustrations could be used to support training objectives in whatever format unit leaders/ trainers would choose to adapt to the AAR and training process. Second would be the capability to produce multi-media take home packages, so that soldiers and units could review their exercises after their training experience has been completed. The third would be the capability to incorporate scenario control information, such as phase lines and boundaries, into the AAR. The last would be the capability to automatically detect and mark certain critical events, such as fratricide, without intervention by the AAR Leader.

DISAF Behaviors and Control

The addition of crowd units, armed civilians, and corresponding behaviors provided a more realistic crowd control training exercise. Smoke grenades were effectively used by the soldiers to mask their movements. Flash-bang grenades effectively suppressed the enemy during room clearing operations. Wounding effects to DISAF entities were consistent with the hit location. The DTServer implementation on DISAF successfully processed C4 explosive detonations issued from both the SVS and DISAF entities. Shots fired from DISAF or the SVS that hit buildings left appropriate "bullet holes".

The ability of a Fire Team Leader to command his SAF entities to move where he desired proved to be easier this year when compared to last year since a "Follow Me" behavior was added that permitted the designated troops to follow the live leader through the VE. The initiation of "follow me" mode was previously performed by the SAF Operator.

DI Simulators

Features that appeared to be well-liked by the soldiers included: grenades, smoke, muzzle flashes from weapons, shadows for AIS Human characters, placement for C4 charges by immersed soldiers, and binoculars. DT Server integration needed additional refinement.

Voice Recognition Federate

The VF demonstrated that a team composed of DISAF entities and commanded by a human can participate meaningfully in an exercise containing live and synthetic teams. The improvements made to the STT software and VF parsing system seemed to overcome to a large degree the speech recognition difficulties experienced during the previous CE. The VF was a robust member of the integrated environment. The VF was able to be reconfigured easily to respond to changes in the network environment, DISAF restarts, changes in scenarios, and differences between individual users.

The VF system successfully parsed 70% of the voice commands during the CE scenarios, as compared with 46% in 2001. Success rates ranged from 47% to 85% between the individual users. The extended use of natural language phrasing and naming conventions seemed to let new VF users utilize the system without focusing on the speech syntax. The VF system allowed humans to command DISAF entities to move either by following the human user or moving relative to landmarks in the virtual terrain. The former method was largely favored by all the VF users, and 85% of all movement orders used the "follow me" command. In general it appeared that the VF was adequate to allow a human to command a team of DISAF entities and allow them to participate in scenarios. However, it was also the case that the DISAF fire team was more difficult to control, particularly to maneuver, than the human fire team, and was therefore more likely to be only marginally involved in scenario events.

CE Command, Control, and Coordination

The Battlemaster position became a bottleneck, in part because off-loading automated tasks, particularly voice control of DISAF, to the Battlemaster was a convenient interim fix when problems were encountered.

Separating the duties of the O/C and the AAR Leader vastly improved the performance of both tasks. The O/C was able to concentrate more on the scenarios and mentally forecast events as they were scheduled to occur. This ensured that items such as environmental conditions and timed events were properly implemented to support each scenario. Having a separate person conduct the AAR removed this requirement from the O/C's additional duty list and gave it the emphasis it required.

Discussion

Overall, the VE STO FY 2002 CE was successful. It provided a realistic and challenging test of the systems and capabilities under development. The results identified both accomplishments and areas for improvement. The systems generally performed well, both as independent systems and as coordinated components of a larger, integrated system. This successful integration was best illustrated by dynamic terrain and smoke grenades. Both DISAF and soldiers in the SVSs could see, shoot through, and move through the holes created by the DTServer, and the AAR system displayed them as well. Smoke grenades produced smoke clouds of the same size shape, and color for the SVSs, DISAF, and DIVAARS. Even when problems did occur, it was generally possible to run the scenarios as planned. When problems were encountered, the causes could usually be identified, and in some cases corrected, during the CE. Problems that could not be corrected immediately were identified as high priority items for post-CE correction.

Perhaps the most significant accomplishments of the VE STO are not reflected in the ratings or performance data that were collected but in the level of sophistication and complexity of the scenarios that were run. In the 1999 CE, at the end of the first year of the STO, five different scenarios were used. All were basically the same: initiate movement to an objective building, react to enemy contact in route, resume movement and finally assault the building. It was always daylight. DISAF could not enter buildings. Few civilians were present, and their behaviors were limited to either standing still or moving on a preplanned route. Buildings could not be breached. Neither force could use smoke or grenades. A hit always equaled a kill. A fire team leader could control DISAF only by giving a verbal command to the DISAF operator, who then implemented that command at his console. Routes for DISAF had to largely be scripted in advance. AARs were limited to linear playback on a stealth viewer. In 2002, there were six different scenarios. Scenarios could be conducted at any time of day or night. DISAF could go anywhere, and could carry out some highly sophisticated behaviors, such as room clearing, autonomously. Civilians moved about freely, as individuals and in crowds, and could be armed. Holes could be blown at any location in any building. Flares, smoke, and grenades were available to all participants. Soldiers could be wounded as well as killed when hit. These factors greatly increased the variety and realism of the training situations that could be presented.

Simulator Capabilities

While it was satisfying to find that soldier ratings of the simulator capabilities were generally higher than in previous years, it was difficult to relate the changes in rating on specific items to a likely cause. For example, why did soldiers give the task "move in single file" a higher rating in 2002 than in 2001? While capabilities have been added to the SVSs, the basic characteristics remain the same. The most likely explanation is that the soldiers responded to the individual items on the basis of both the specific item content and their perception of the overall quality of their experience in the simulators. The new capabilities, like smoke and grenades, which were rated highly (and the absence of which was a cause for complaint in prior years), may have increased the overall quality of this experience and, by extension, the ratings of individual tasks that were not directly affected. Another possibility is that the scouts who

participated this year had less experience with live urban exercises, and therefore had less demanding standards for comparison, than the light Infantry soldiers who participated in previous years.

Other factors may have had less straightforward but nevertheless substantial effects on the ratings. As described above, the training scenarios have become increasingly challenging and complicated over the course of the STO. While this made the training more realistic, it required the soldiers to try to perform more complicated tasks in the simulators, and may also have made it more likely that the soldiers would encounter the limits of the simulators. See, for example, the discussion of the dynamic terrain ratings below. The video gaming experience of the soldiers may also have been a factor in the ratings. Reported computer use, in hours per week, has been about the same across the four years of the STO. We did not ask about video game use, but it appeared from the interviews and informal interactions that the game-playing experience of the soldiers has increased over the years. On the one hand, their gaming experience has given them opportunity to acquire necessary "basic skills" that make it easier to learn to function in the SVSs. One group of soldiers reported in their interviews that they had no difficulty learning to use the SVSs because "We're the Nintendo generation." On the other hand, the impact of the increasing sophistication of computer and video games may have caused soldiers to have higher standards for simulator performance. The simulator capabilities are being compared with increasingly realistic and sophisticated commercial products. This has, in effect raised the standards by which automated entities and environments are judged.

Some soldier interface needs are recurring. It is clear from review of the questionnaire data that precise movement in the SVSs has been a consistent problem over the life of the STO. Probably this is inherent in the SVS design. A soldier centered under the tracker in the SVS is several feet from the visual display. Virtual entities and objects in the area between the soldier and the screen cannot be rendered clearly or accurately on the screen. This makes precise maneuver difficult. However, this approach has other advantages in that it is less likely to produce symptoms of simulator sickness or create safety issues than would a head-mounted display. It also provides a relatively high resolution display at a reasonable cost.

Training Effectiveness

Leader ratings of training effectiveness constitute perhaps the biggest success story of the STO. Since 1999, we have seen a consistent increase in leader ratings of training effectiveness across 10 of the 11 tasks which they were asked to rate. Like the ratings of simulator capability, these ratings were likely influenced by the changes in the backgrounds and experience of the leaders and administrative changes (primarily the separation of the roles of the O/C and the AAR Leader).

This year, the self ratings were supplemented with independent ratings of unit behaviors. Those data revealed two trends. The first was a general upward trend in ratings prior to the final one or two exercises. The second was generally better performance on the second of two comparable exercises than on the first. Our overall conclusion was that the soldiers were learning, but that other factors were affecting their performance as well. Clearly, some very

powerful factor or factors had a negative effect on their performance on the final scenario. Since the last and next-to-last scenarios were different for each squad, the drop in performance cannot be attributed to the difficulty of a particular scenario. Fatigue is the most likely cause. Prior to the CE, we did not consider the effects of fatigue because the training was not physically demanding, was conducted in air-conditioned buildings, and the actual conduct of each scenario lasted only about 20 minutes. However, it appeared to be mentally demanding. The soldiers were highly involved and wanted to perform well. Observers noted the fatigue at the end of the second day. Fatigue was more likely to be a factor on the second day, which consisted of five tactical exercises, than the first, which consisted of train-up activities plus three exercises.

There is a broad range of tactical skills that could conceivably be trained in VE. At one end of the continuum are small unit leader decision-making skills. Pleban, Eakin, Salter, and Matthews (2001) found that these skills could be trained effectively in VE. Training these skills does not require a high fidelity, fast, or precise interface with the virtual world. Success is more likely to depend on the scenarios and the quality of the role-players. At the other end of the continuum are the specific squad drills and tasks, like building clearing, which involve less decision making, more communication and coordination among unit members, but above all require rapid and precise positioning, movement and use of weapons. A recent experiment by Pleban and Salvetti (2003) indicates that, while there are a number of interface and technology problems to be overcome, VE nevertheless shows promise for this type of training as well, although it appears not to be effective as real world training at present. The types of squad-level exercises conducted during the last two CE's fall somewhere in the middle, targeted at improving leader decision-making and command and control skills in a variety of mission types.

Given the current state of technology, it does not appear that VE is an effective complete replacement for real world tactical training. However, it could be used effectively for some types of training and some stages of training. VE training could provide the walk phase of the training, concentrating on improving the decision-making, situation awareness, communication, and coordination skills. Real world training would place greater emphasis on the motor skills. VE training also has the advantage of being more flexible, in that terrain databases and environmental conditions can be changed more rapidly than a real world urban training center.

AAR System

DIVAARS performed very well, although in looking at the DIVAARS ratings it must be kept in mind that the AAR is a product of the combination of a skilled AAR Leader and the AAR system. The decision to assign a person to the role of AAR Leader without other responsibilities also seemed to be a good one. However, he was ably supported by the DIVAARS. Because the AAR Leader was only introduced to the AAR system two days prior to the conduct of his first AAR, it was decided not to have him try to operate the DIVAARS, but instead to direct a DIVAARS operator. Clearly more than two days is required to achieve the high level of proficiency that the AAR Leader needs to make the rapid actions necessary to observe the key battlefield events and organize an AAR quickly. Changes to both the operator interface and to basic DIVAARS capabilities would serve to make it easier for the AAR Leader to function

alone. These include a simplified mechanism for flying through the database (perhaps using a joystick rather than a mouse), and automatic detection of important scenario events.

Voice Control of DISAF

Voice control of DISAF showed substantial improvement over the previous year. Nevertheless, voice control of DISAF by the Bravo Team Leader was still a difficult task. Records kept by observers indicated that 70% of the commands were recognized correctly. This is consistent with the estimates given by the B Team Leaders. Increasing the recognition accuracy of the COTS speech recognition system in a noisy environment with a speaker under stress is probably the factor which would do the most to improve overall performance.

Dynamic Terrain

For most functions, the 2002 ratings were higher than the ratings from the previous year. This trend did not hold for the dynamic terrain breaching function. The first four items in Table 6 are instances in which ratings decreased significantly from the preceding year. Three of the items are clearly based on the breaching (ability to create a blow hole) capability. The first item includes "building damage" the rating of which may reflect in part the breaching capability.

The 2001 CE was the first in which a dynamic terrain server provided the capability to breach (create a hole in) a wall during the VE exercises. Real-time modification of the various databases required during the simulation was a very complicated process which sometimes resulted in unexpected and unrealistic changes in the databases. If an appropriate munition, like an AT-8, hit a wall at the right place and at the right angle a usable breach was usually created. However, seemingly minor variations in either point or angle of impact not only failed to produce a usable breach (in terms of size, shape, or location), but could also produce unwanted changes to the databases such that the remainder of an exercise was degraded. Therefore, during the 2001 CE, the use of the capability was for the most part limited to situations in which the initial orders presented to the squad specifically called for a breach to be created during the mission. The orders identified the specific wall of the building to be breached that would be entered as part of the mission objective. When the squad was in position, the squad leader would call the platoon leader to request that the breach be made at that time. The platoon leader then called for an adjacent unit to fire an AT-8 round at the wall. The SAF operator would then fire the round from a carefully pre-selected position. (Scenarios were tested before the CE to make sure that the targeted spot on the wall and angle of impact resulted in a suitable breach.)

The 2002 CE employed a much less restricted approach to the use of the breaching capability. The squad leader could decide during a mission that the use of breaching would provide a tactical advantage. The squad carried enough C4 to potentially create several breaches during each mission and indeed on several missions the squads used the breaching capability more than once. Thus, for the 2002 CE the breaching capability was used much more frequently than the preceding year. However, the percentage of successful (useable) breaches was much lower. On several occasions the size, shape and/or location of the breach was not what the squad expected or wanted, and this was reflected in the ratings.

The relatively low ratings of the realism of the breaching capability do not indicate that the soldiers did not think this was an important capability. The breaching capability was mentioned favorably during the interviews. Finally, it should be noted that some of the most successful exercises involved well thought out use of breaching to avoid entering a building through a door or window that was covered by the OPFOR.

DISAF Performance

DISAF capabilities have increased enormously since the start of the VE STO. This permits more realistic scenarios. DISAF does some things better than others. For example, they are quite good (better than human soldiers) at detecting and firing upon the enemy, but control of their movement, particularly in a dynamic situation, is awkward.

Simulator Sickness

The occurrence of simulator sickness symptoms was very low, averaging the equivalent of 1.36 slight symptoms per soldier at the end of the training day, compared with 1.16 at the beginning. The largest increases were in headache and eyestrain (+.17 each). The low level of occurrence of symptoms likely results from the use of short scenarios (approximately 20 minutes each) separated by non-immersive activities, and the use of rear-projection displays in the SVSs. Simulator sickness does not seem to be an obstacle to longer-duration training scenarios.

Conclusions and Future Directions

Substantial improvements have been made during the last four years in the capability of virtual simulation to provide training for the leaders of small dismounted Infantry units. These developments in technology have greatly increased the level of realism that is possible through virtual simulation, and the breadth of tasks that can be trained. While the samples are small, both leader self-ratings and independently-obtained performance scores during this CE indicate that soldier skills improved with practice in VE. Moreover, leader-self-ratings of skill improvement have increased regularly since the first year of the STO. The FY 2001 and FY 2002 CEs have focused on sustainment and support operations, and in that context, the leaders reported more improvement in command and control, coordination and communication, planning, and situational awareness skills than in skills conducting specific unit tasks or battle drills. Similarly, Pleban et al. (2001) found VE effective for training platoon leader decision making skills.

Given the current state of technology, it appears that VE could be used effectively for some types of training and some stages of training. VE could be used for the walk phase of the training, concentrating on improving the decision making, situation awareness, communication, and coordination skills, while real world training could place greater emphasis on the motor skills. Therefore, although there are still further improvements that can be made in the individual technologies, as identified earlier in this report, the next step should be an advanced development

effort, taking a total systems approach, to produce a prototype VE training system for the leaders of small dismounted Infantry units.

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Appendix A: List of Acronyms

| | |
|----------|---|
| AAR | After Action Review |
| AIS | Advanced Interactive Systems, Inc. |
| ARI | U.S. Army Research Institute for the Behavioral and Social Sciences |
| ARI-IFRU | U.S. Army Research Institute, Infantry Forces Research Unit |
| ARI-SSRU | U.S. Army Research Institute, Simulator Systems Research Unit |
| ARL-CISD | U.S. Army Research Laboratory, Computational and Information Sciences Directorate |
| ARL-HRED | U.S. Army Research Laboratory, Human Research and Engineering Directorate |
| AUSA | Association of the United States Army |
| CE | Culminating Event |
| CGF | Computer-Generated Forces |
| CIS | Combat Instruction Sets |
| COTS | Commercial-off-the-Shelf |
| CTDB | Compact Terrain Database |
| DI | Dismounted Infantry |
| DIS | Distributed Interactive Simulation |
| DISAF | Dismounted Infantry Semi-Automated Forces |
| DIVAARS | Dismounted Infantry Virtual After Action Review System |
| DOTMLPF | Doctrine, Organization, Training, Material, Leadership, Personnel, and Facilities |
| DT | Dynamic Terrain |
| DTLOMS | Doctrine, Training, Leader Development, Organization, Materiel, and Soldier |
| DTServer | Dynamic Terrain Server |
| DVD | Digital Video Disc |
| DWN | Dismounted Warrior Network |
| DWN ERT | Dismounted Warrior Network Enhancements for Restricted Terrain |
| GUI | Graphical User Interface |
| HLA | High Level Architecture |
| HMD | Helmet Mounted Display |
| IC | Individual Combatant |
| I-Port | Individual Portal |
| IST | University of Central Florida Institute for Simulation and Training |
| JRTC | Joint Readiness Training Center |
| LWTB | Land Warrior Test Bed |
| MES | Multiple Elevation Surface |
| ModSAF | Modular SAF |
| MOS | Military Occupational Specialty |
| MOUT | Military Operations in Urban Terrain |
| NCO | Non Commissioned Officer |
| O/C | Observer/Controller |
| ODT | Omni-Directional Treadmill |
| OPFOR | Opposing Forces |

| | |
|---------|---|
| OTB | OneSAF TestBed |
| PC | Personal Computer |
| PDU | Protocol Data Unit |
| PVD | Plan View Display |
| RPR FOM | Real-time Platform Reference Federation Object Model |
| SAF | Semi-Automated Forces |
| SASO | Support and Sustainment Operations |
| SAW | Squad Automatic Weapon |
| SIMNET | Simulation Network |
| SOM | Simulation Object Model |
| SSE | Squad Synthetic Environment |
| STO | Science and Technology Objective |
| STT | Speech to Text |
| SVS | Soldier Visualization Station |
| STRICOM | U.S. Army Simulation, Training, and Instrumentation Command |
| TDC | Technology Development Center |
| TRADOC | U.S. Army Training and Doctrine Command |
| VE | Virtual Environment |
| VICS | Virtual Individual Combat Simulator |
| VF | Voice Federate |

Appendix B. Culminating Event Scenarios

This appendix contains the General Mission Statement that applies to all scenarios as well as the Mission Planning Briefing and Scenario Description for each scenario. Scenarios are not numbered consecutively.

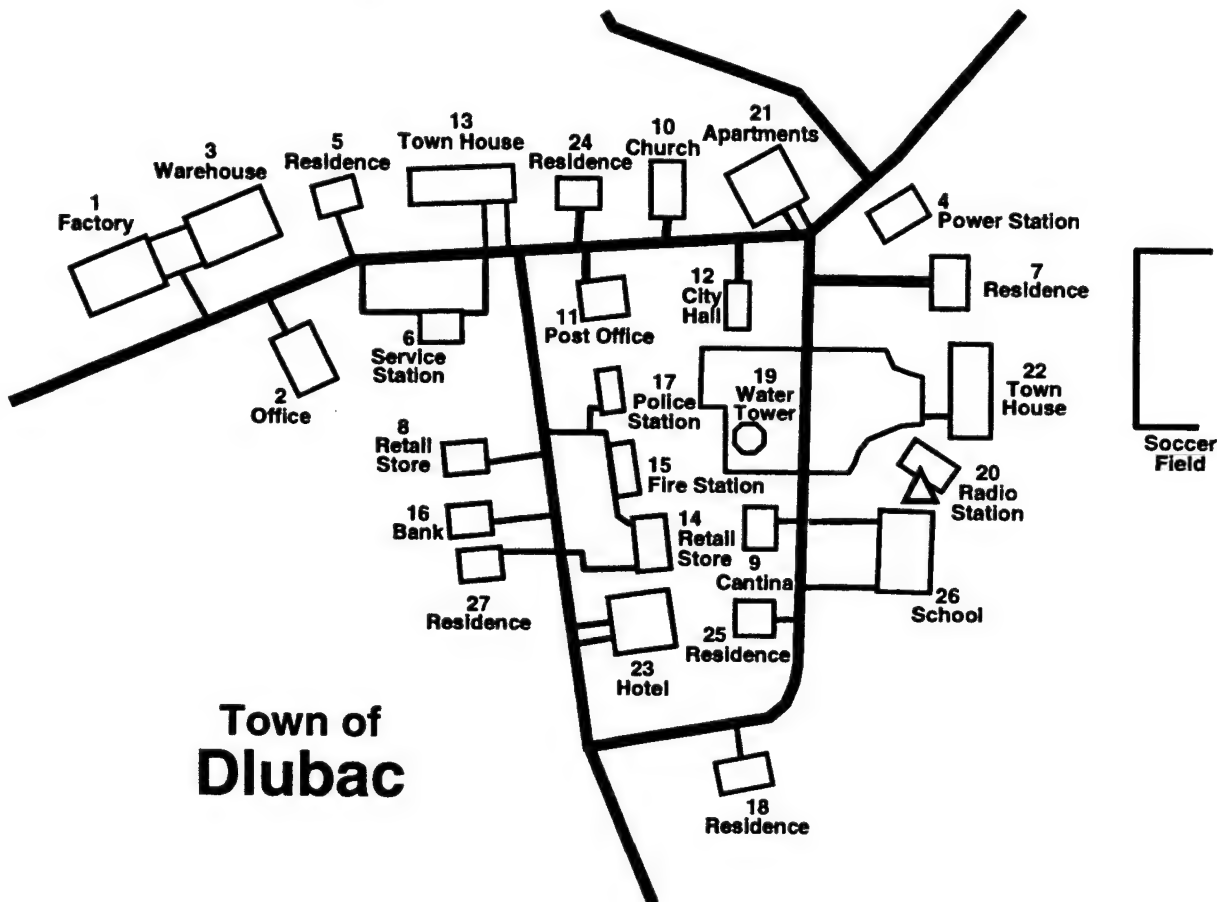
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General Mission Statement

Associated Press
Dlubac, El Polksa

The U.N. Protection Force continues to closely monitor conditions in the town of Dlubac located in the providence of El Polksa. Rebel forces from the radical nationalist group Black Sabbath have been linked to several terrorist bombings and attacks on the nearby towns. The strategic importance of Dlubac, overlooking one of the major routes entering El Polksa, makes this town a prime target for rebel activities. The U.S. 1-11th Infantry Battalion attached to the U.N. Protection Force has been tasked with coordinating U.N. activities within the region.



Scenario # 4: Roving Patrol

Mission Planning Briefing

Your unit is always the 2d Squad of the 2d Platoon.

Enemy Situation: Enemy presence is considered light, capable of conducting military operations in the immediate region with forces less than platoon-size, supported by mortars. There is no heavy threat. Last reported enemy activity in the region was 2 nights ago when a squad-sized raid was conducted in the neighboring town of Polo, 3 kilometers to the northwest.

Mission of Higher Units: Company B, your company, has occupied the town of Dlubac (pronounced d-lü-běk). 1st and 3d Platoons have established a hasty defense along the perimeter of the town until daylight. 2d Platoon, your platoon, is the company reserve. 1st and 3d Squads have set up checkpoints 1 and 2, respectively at the north and south ends of the town. 2d Squad is the platoon reserve. The platoon mission is to maintain the peace in the town. The platoon command post is Building 4, the Power Station. The town population of Dlubac is considered to be overall friendly. However, there may be insurgents and insurgent sympathizers within the town's population.

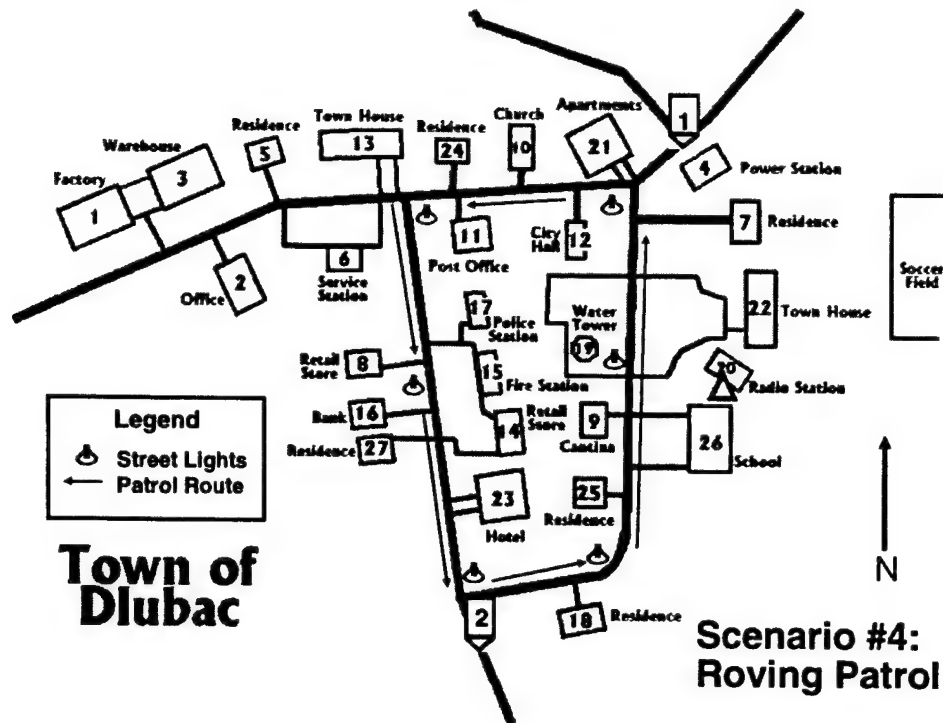
Your Mission: Your mission is to conduct a roving squad-size patrol. The start point is outside Bldg 4 (Power Station). The route is counter-clockwise along the circular portion of the interior road network. You will move in blackout, with no white lights. You will be issued both smoke and flashbang grenades and hand-launched flares. The smoke grenades are used to possibly assist movement under fire. The flashbang grenades are used for room clearing. Per the unit SOP, the hand-launched signal flares are for night visibility (white parachute), identification (yellow parachute), lifting and shifting fires (green parachute), and cease fire (red parachute). Both red smoke and red parachute flares are emergency cease fire signals. In the event you encounter hostile activities, do not to let the town streetlights silhouette your movement - shoot them out.

Rules of Engagement: The ROE is restrictive - only return fire after fired upon. Building 21 (Apartments) is a former hospital. It is now used as apartments to house refugees since the medical staff departed because of the civil unrest. As a result, it may be fired on in self-defense, if necessary.

Your immediate task is to brief your squad members and organize the squad for the roving patrol. Call signs remain constant.

What are your questions?

The scenario will begin once you have briefed your subordinates and the patrol is preparing to deploy from the Bldg 4, the Power Station.



| Scenario Set-Up and Demonstrated Technologies | | |
|---|----------------------------------|---|
| Time of Day: Night 2000hrs | Technologies | |
| Weather: Clear | Crowd Behavior | X |
| Wind effect: 7 kph | Armed Civilian | X |
| Wind direction: North | Follow Me/IC Station Keeping | X |
| Exterior Lighting: On | Smoke Grenade | X |
| | Stun/Flashbang Grenade | X |
| | Hand Emplaced/Satchel Charge | |
| | Hand-Launched Signal Flares | X |
| | After-Action Review (AAR) System | X |

The unit is always the 2d Squad of the 2d Platoon.

Mission Overview: The company has occupied the town. 1st and 3d Platoons have established a hasty defense along the perimeter of the town until daylight. 2d Platoon is the company reserve. 1st and 3d Squads have set up checkpoints 1 and 2, respectively at the north and south ends of the town. 2d Squad is platoon reserve. It has been ordered to conduct a roving squad-size patrol. The start point is inside Bldg. 4 (Power Station). The route is counter-clockwise along the circular road network. 2d Squad is to move in blackout, with no white lights. As the squad moves in the vicinity of Bldg. 8 (Retail Store), they come under fire by OPFOR from Bldg. 23 (Hotel).

| Set-Up Prior to Beginning Scenario | |
|------------------------------------|--|
| 1 | Start point is Bldg. 4 (Power Station). Objective is Bldg. 23 (Hotel). |
| 2 | Add furniture to Bldg. 23 (Hotel) lobby and ground floor. |
| 3 | Streetlights are on. Patrol will have to shoot out a streetlight before assaulting Bldg. 23 (Hotel). |
| 4 | Position 1 COB to walk in front of 2d Squad from Bldg. 8 (Retail Store) to Bldg. 17 (Police Station). Move COB as squad makes turn onto road. |
| 5 | Add 4 to 6-person non-hostile crowd in front of Bldg. 15 (Fire Station). Once firing begins crowd will disperse moving away from gunfire. |
| 6 | Add 2 OPFOR in Bldg. 23 (Hotel). 1 live OPFOR on desktop is in lobby. The armed civilian is on first floor in back of building. Add 1 dead OPFOR near stairwell landing. |
| 7 | Add rubble to Buildings 27 (Residence) and 23 (Hotel). |
| 8 | Add two COBs hiding in Building 23 (Hotel) lobby behind furniture. |
| 9. | Cultural objects will be added to each scenario after a run through to determine that the data base isn't bogged down with existing requirements. |

Scenario: This scenario takes place during darkness. The platoon leader has issued the operation order (OPORD). The scenario begins with the 2d Squad in reserve in Bldg. 4 (Power Station), preparing to begin the squad-sized roving security patrol. Streetlights are on. The route is counter-clockwise along the circular road network (see map). The squad leader was told he was issued both smoke and flashbang grenades and hand-launched flares. Per the unit SOP, the hand-launched signal flares are for night visibility (white parachute), identification (yellow parachute), lifting and shifting fires (green parachute), and cease fire (red parachute). He was also warned that if he has to go tactical, not to let the street lights silhouette his movement, to shoot them out. The squad will form up in front of Bldg. 4 and move along the first segment of the route unmolested. As they make the turn south past the post office (Bldg. 11), they should see 1 COB walk from the Retail Store (Bldg. 8) to the Police Station (Bldg. 17). Squad leader should note and report presence of a non-hostile 4 to 6-person crowd milling in front of the Fire Station (Bldg. 15). Before the squad reaches Retail Store (Bldg. 8), the squad leader will receive a radio call from the platoon leader stating that a COB had just informed him that he saw 3 armed people entering the Hotel (Bldg. 23) and heard gunfire. The platoon leader will:

- (1) tell squad leader to move his squad to a covered position behind one of the buildings;
- (2) use flares and smoke as necessary;
- (3) remember to shoot out the street lights so they don't silhouette his movement,
- (4) remind the squad leader of the ROE.

The squad should shoot out the street light and begin tactical movement. Once the squad reaches the Bank (Bldg. 16), they can be engaged by the OPFOR in the Hotel (Bldg. 23). Once firing begins, the crowd in front of the Fire Station (Bldg. 15) should disperse moving away from the firing. The squad should take cover, establish a base of fire, and begin its assault. Smoke and flares should be used per SOP. The squad leader should also report this action. If the squad leader fails to report, the platoon leader will ask for a SITREP. The squad assaults the hotel. As the assault begins, the platoon leader calls and states that a civilian police officer, working as hotel security, has killed 1 of the OPFOR and limited the remaining 2 OPFOR to the ground

floor. He also reports civilians hiding in the lobby. The squad must employ flashbang grenades to help clear the building. ENDEX will occur when the mission is accomplished or when the squad can no longer perform its mission.

Scenario # 6A: Hostage Rescue

Mission Planning Briefing

Your unit is always the 2d Squad of the 2d Platoon.

Enemy Situation: Enemy presence is considered light, capable of conducting military operations with forces less than platoon-size. There is no mechanized, motorized, or indirect fire threat. Yesterday, a platoon-sized force was caught in the open moving 4 kilometers to the southwest of Dlubac (pronounced d-lü-běk). In the ensuing firefight, it was seriously mauled. Most of the enemy force was destroyed. The town population is considered to be friendly. However, there may be surviving insurgents from yesterday's engagement and insurgent sympathizers within the town's population. The town has a police force. It is a local militia force. Since it is made up of local residents, it should not be considered a trained military force.

Mission of Higher Units: Your company is defending the town of Dlubac with 1st PLT in the East and 3d PLT in the West. The 2d PLT, your platoon, is the company reserve. The platoon mission is to maintain the peace. 1st Squad is manning Checkpoint #1 on the road entrance adjacent to Building 4 (Power House) at the northeast corner of the town. 3d Squad is manning Checkpoint #2 on the road entrance adjacent to Building 23 (Hotel) at the southern corner of the town. The platoon has received word that 3 armed OPFOR have seized hostages and are located in Bldg 13 (Town House). The local police have surrounded the building, but cannot gain entry. The local police chief has requested assistance. There are 2 COBs being held hostage.

Your Mission: 2d Squad, your squad, will conduct a deliberate attack on Bldg 13 (Town House) to destroy the enemy force and free any hostages. Your start point is the East side of Bldg 23, the Hotel. You will move in blackout, with no white lights. You will follow ROUTE BLUE to Bldg 4, the Power Station, and shoot out the transformer that controls the lights on the North and East sides of town. From there you will move to an assault position on the South side of Bldg 24 (Residence) to begin your assault on Bldg 13 (Town House). The enemy location is confirmed as the first floor of the 1st apartment on the East end of the building. There will be no movement in the direction of Bldg 13 (Town House) until after the transformer is shot out. You may also need to shoot out the street light in front of Bldg 21 (Municipal Center) to avoid silhouetting your squad. You will be issued smoke, fragmentation, and flashbang grenades, hand-launched signal flares, and two satchel charges. Per unit SOP, the flares are for night observation (white parachute), identification (yellow parachute), lifting and shifting fires (green parachute), and cease fire (red parachute). You will use the satchel charges, as necessary, to gain entry into Bldg 13 (Town House). Use any color smoke grenades except red to cover your final assault. Red smoke is universal cease fire signal. Prior to employing smoke, confirm the wind direction with me. Flashbang grenades will be used to clear rooms despite possible injury to civilian hostages.

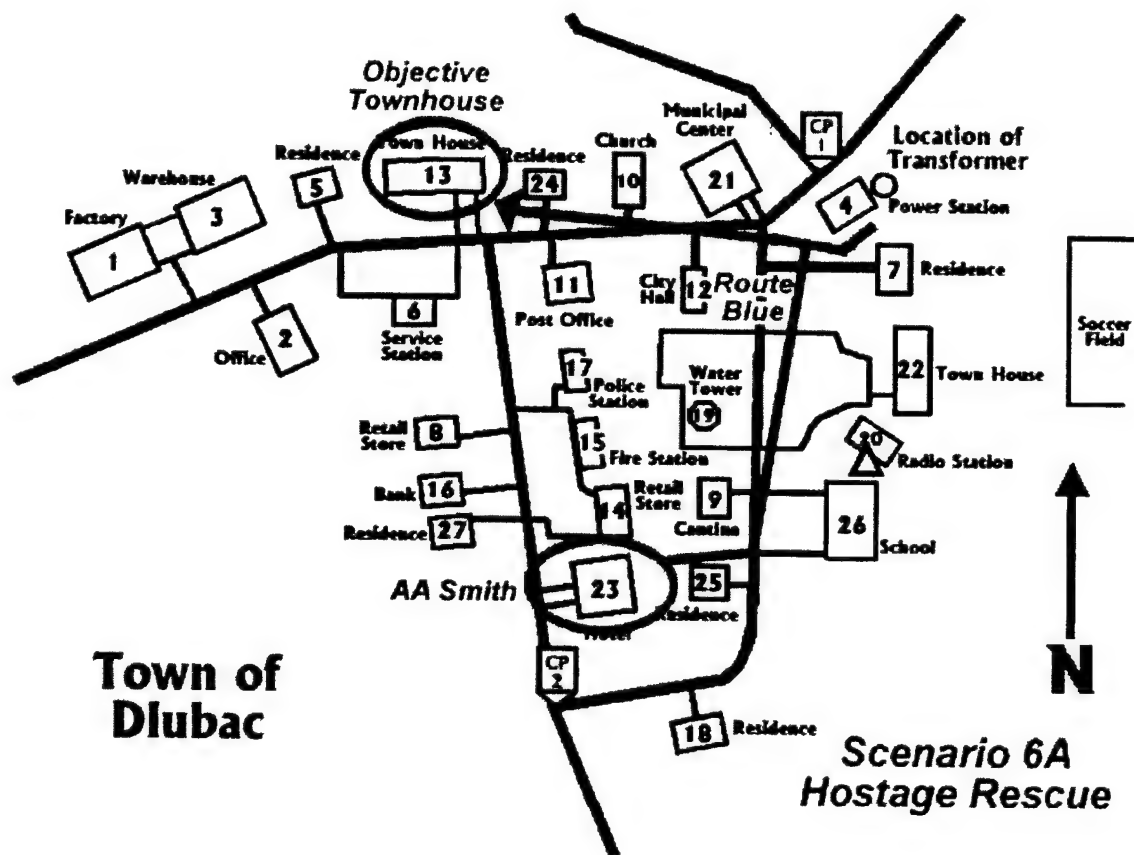
Rules of Engagement: Since the overall population of Dlubac is considered friendly, the rules of engagement are very restrictive. There will be no weapon firing within the town limits except in self-defense or in defense of the town against a confirmed enemy presence. Enemy targets must be positively identified. Self-defense is defined as a serious threat to life or limb. A

serious threat is considered gunfire or the presence of an uncontrolled mob armed with life-threatening weapons such as knives, pikes, metal poles, etc. Every effort must be made to disarm the situation prior to the use of deadly force. Remember, there are three friendly police officers located in the area surrounding Bldg 13. Weapons control status is tight.

Your immediate task is to brief your squad members and organize the squad for movement. Call signs remain constant.

What are your questions?

The scenario will begin once you have briefed your subordinates and are prepared to deploy from inside the platoon CP location at Bldg 23 (Hotel).



Scenario Description

| Scenario Set-Up and Demonstrated Technologies | | |
|---|----------------------------------|---|
| Time of Day: Night 1800hrs | Technologies | |
| Weather: Light Fog | Crowd Behavior | X |
| Wind effect: 2 kph | Armed Civilian | X |
| Wind direction: From East | Follow Me/IC Station Keeping | X |
| Exterior Lighting: On | Smoke Grenade | X |
| | Stun/Flashbang Grenade | X |
| | Hand Emplaced/Satchel Charge | X |
| | Hand-Launched Signal Flares | |
| | After-Action Review (AAR) System | X |

The unit is always the 2d Squad of the 2d Platoon.

Mission Overview: The company is defending the town with 1st Platoon in the East and 3d Platoon in the West. 2d PLT is the company reserve. 1st Squad is manning CP #1 adjacent to Bldg 4. (Power House) in the north. 3d Squad is manning CP #2 adjacent to Bldg 23. (Hotel) in the south. The 2d Squad is the platoon reserve, located in Bldg 23. (Hotel). 3 armed OPFOR have seized hostages and are located in Bldg 13. (Town House). The local police have surrounded the building, but cannot gain entry. The local police chief has requested assistance. There are 2 COBs being held hostage. 2d Squad is ordered to conduct a deliberate attack on Bldg 13. (Town House) to free the hostages.

| Prior to Beginning Scenario | |
|-----------------------------|--|
| 1. | Start point is Bldg. 23 (Hotel). End point (objective) is Bldg. 13 (Town House). |
| 2. | Streetlights are on. |
| 3. | Interior lights are on in all buildings. |
| 4. | Add rubble to Bldgs 13 (Town House) 24 (Residence), 11 (Post Office), and 6 (Service Station). |
| 5. | Add furniture to Bldg. 13 (Town House). |
| 6. | Confirm Transformer #2 at Bldg. 4 (Power Station) can be shot out prior to exercise. |
| 7. | Add 3 OPFOR in 1 st floor apartment (east end) of Bldg. 13 (Town House). 1 live OPFOR is on desk-top. 1 OPFOR is the armed civilian. 1 OPFOR is dead. |
| 8. | Add 3 "police" (RBD soldier_dcu) located outside at the corners of Bldgs. 24 (Residence), 5 (Residence) and 6 (Service Station) forming a cordon around Bldg. 13 (Town House). Police officers will move inside buildings when 2d Squad arrives. |
| 9. | Add 2 civilians on the battlefield (COBs) as hostages in Bldg. 13 (Town House). |
| 10. | Add 4-6 civilian crowd vicinity of North side of Bldg 6 (Service Station). Crowd will move away from firing upon detonation of satchel charge firing. |
| 11. | DI SAF 1st Squad fire team visible at Checkpoint #1. |
| 12. | Cultural objects added. |

Scenario: This scenario takes place at night. The operation order has been issued by the platoon leader. The scenario begins with the 2d Squad at the 2d PLT command post in Building 23 (Hotel). 3 OPFOR have taken hostages and are located in Building 13 (Town House) (1 desktop, 1 armed civilian, and 1 dead OPFOR and 2 COBs will be positioned in Building 13). There are 2 COBs being held hostage. The local police chief has requested assistance. The police have surrounded the building, but cannot gain entry (3 RBD_dcu as police placed around building). The 2d Squad is ordered to conduct a deliberate attack to free the hostages in Bldg 13 (Town House). To accomplish this, the 2d Squad must follow ROUTE BLUE to Bldg 4 (Power Station), shoot out the transformer located there, then move to an assault position on the South side of Bldg 24 (Residence) to begin its assault on Bldg 13 (Town House). The platoon leader:

- (1) Confirms enemy location on first floor of the 2d Apartment on East side of Bldg 13 (Town House);
- (2) Reinforces order of no assault on Bldg 13 (Town House) until after the transformer at Bldg 4 (Power Station) is shot out;
- (3) The squad leader is told he will be issued both smoke, fragmentation, and flashbang grenades, hand-launched signal flares, and two satchel charges. Per the unit SOP, the hand-launched signal flares are for night visibility (white parachute), identification (yellow parachute), lifting and shifting fires (green parachute), and cease fire (red parachute).
- (4) Use satchel charge to gain entry into Bldg 13 (Town House)
- (5) Use any color smoke grenades except red to cover assault, but check wind direction with the platoon leader prior to using smoke; red smoke is universal cease fire signal.
- (6) Use flashbang grenades to help clear rooms.

The squad will form up to the East of Bldg 23 (Hotel) and move along ROUTE BLUE unmolested. The squad leader should report when he arrives at the assault position, commences the assault, and when his mission is completed. If the squad leader does not report, the platoon leader will ask for repeated SITREPs. ENDEX will occur when the mission is accomplished or when the squad can no longer perform its mission.

Scenario # 6B: Hostage Rescue

Mission Planning Briefing

Your unit is always the 2d Squad of the 2d Platoon.

Enemy Situation: Enemy presence is considered light, capable of conducting military operations with squad-size forces. There is no mechanized, motorized, or indirect fire threat. The successes of the recent U.S-led Spring offensive has left enemy forces decimated and incapable of mounting sustained operations. Recent enemy activities have focused on hostage ransom situations in an effort to discredit the government and obtain much needed capital for equipment and weapons. The town of Dlubac (pronounced d-lü-běk) is considered to be friendly. However, there may be insurgents and insurgent sympathizers within the town's population. The town has a police force. It is a local militia force. Since it is made up of local residents, it should not be considered a trained military force.

Mission of Higher Units: Your company is defending the town of Dlubac with 1st PLT in the East and 3d PLT in the West. 2d PLT, your platoon, is the company reserve. The platoon mission is to maintain the peace. 1st SQD is manning Checkpoint #1 on the road entrance adjacent to Building 4 (Power House) at the northeast corner of the town. 3d SQD is manning Checkpoint #2 on the road entrance adjacent to Building 23 (Hotel) at the southern corner of the town. Local police reported that 3 armed insurgents were discovered in the market place adjacent to the Cantina (Bldg 9). Their apparent target was the School (Bldg 26) where they hoped to capture hostages for ransom and safe passage. After a heated gun battle, the insurgents took refuge in Bldg 25 (Residence). Local police casualties were high and as a result, the local police chief has requested assistance. It is believed that 1 or more of the insurgents are wounded. The number of family members being held hostage in Bldg 25 (Residence) is at least 2 COBs.

Your Mission: 2d SQD will conduct a deliberate attack on Bldg 25 (Residence) to destroy the enemy force and free any hostages. Your start point is the Warehouse (Bldg 3). You will move in blackout, with no white lights. You will move to Bldg 2, the Office, and shoot out the transformer that controls the lights on the West side of town. From there you will move along ROUTE REAPER to an assault position on the North side of Bldg 23 (Hotel) to begin your attack on Bldg. 25 (Residence). If necessary, shoot out Streetlight #2 located in front of Bldg. 16 (Bank) to avoid silhouetting your squad. You will be issued smoke, fragmentation, and flashbang grenades, hand-launched signal flares, and two satchel charges. Per unit SOP, the flares are for night visibility (white parachute), identification (yellow parachute), lifting and shifting fires (green parachute), and cease fire (red parachute). You will use the satchel charges, as necessary, to gain entry into Bldg 25 (Residence). Use any color smoke grenades except red to cover your final assault. Red smoke is universal cease fire signal. Prior to employing smoke, confirm the wind direction with me. Flashbang grenades will be used to clear rooms. You will report your departure from the CP, when you begin your initial assault, and final status. Is that clear?

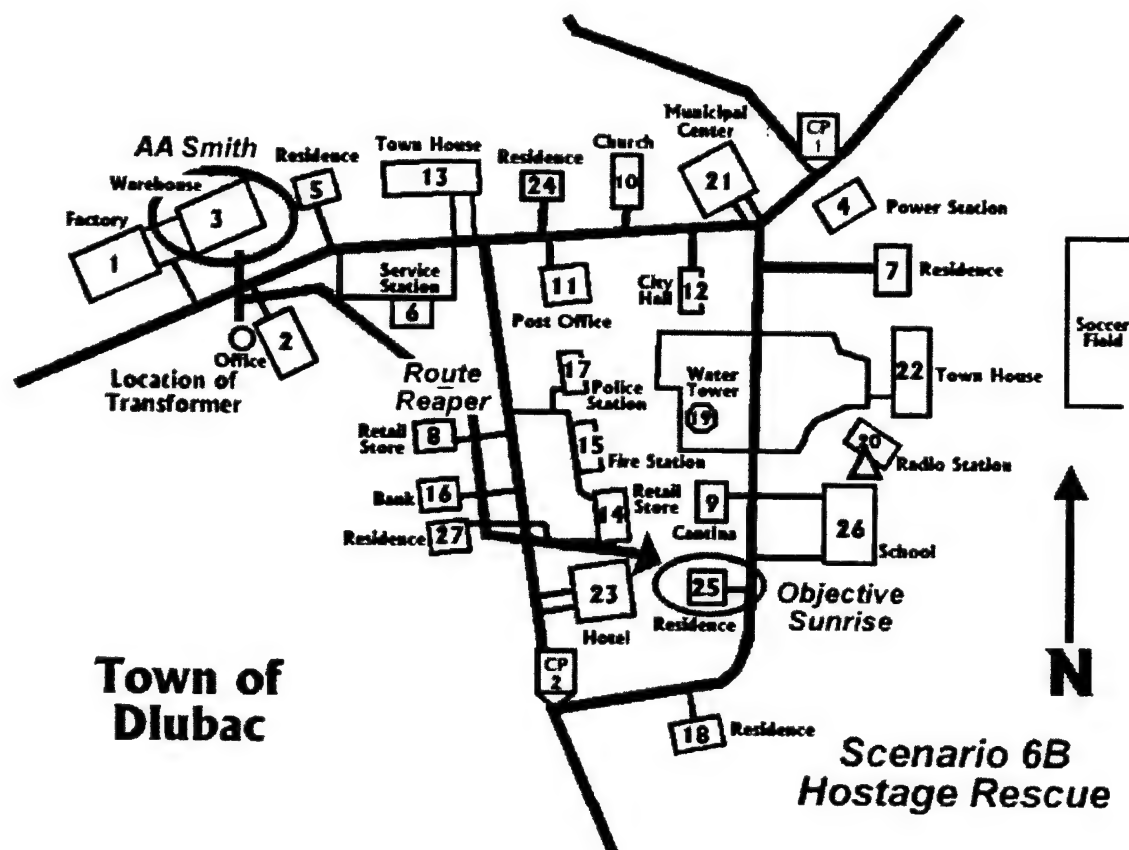
Rules of Engagement: Since the overall population of Dlubac is considered friendly, the rules of engagement are very restrictive. There will be no weapon firing within the town limits except in self-defense or in defense of the town against a confirmed enemy presence. Enemy targets

must be positively identified. Self-defense is defined as a serious threat to life or limb. A serious threat is considered gunfire or the presence of an uncontrolled mob armed with life-threatening weapons such as knives, pikes, metal poles, etc. Every effort must be made to disarm the situation prior to the use of deadly force. Weapons control status is tight.

Your immediate task is to brief your squad members and organize the squad for movement. Call signs remain constant.

What are your questions?

The scenario will begin once you have briefed your subordinates and are prepared to deploy from inside the platoon CP location at Bldg 3 (Warehouse).



Scenario Description

| Scenario Set-Up and Demonstrated Technologies | | |
|---|----------------------------------|---|
| Time of Day: Night 1800hrs | Technologies | |
| Weather: Light Fog | Crowd Behavior | X |
| Wind effect: 3 kph | Armed Civilian | X |
| Wind direction: From East | Follow Me/IC Station Keeping | X |
| Exterior Lighting: On | Smoke Grenade | X |
| | Stun/Flashbang Grenade | X |
| | Hand Emplaced/Satchel Charge | X |
| | Hand-Launched Signal Flares | |
| | After-Action Review (AAR) System | X |

The unit is always the 2d Squad of the 2d Platoon.

Mission Overview: The company is defending the town with 1st Platoon in the East and 3d Platoon in the West. 2d PLT is the company reserve. 1st Squad is manning CP #1 adjacent to Bldg. 4 (Power House) in the north. 3d Squad is manning CP #2 adjacent to Bldg. 23 (Hotel) in the south. The 2d Squad is the platoon reserve located in Bldg. 3 (Warehouse). The local police have reported that 3 armed OPFOR have seized hostages and are located in Bldg. 25 (Residence). The local police chief has requested assistance. There are 2 COBs being held hostage. 2d Squad is ordered to conduct a deliberate attack on Bldg. 25 (Residence) to free the hostages.

| Prior to Beginning Scenario | |
|-----------------------------|---|
| 1. | Start point is Bldg. 3 (Warehouse). End point (objective) is Bldg. 25 (Residence). |
| 2. | All streetlights are on. |
| 3. | All interior lights are on in buildings. |
| 4. | Add rubble to Bldgs. 8 (Retail Store), 25 (Residence), and 23 (Hotel). |
| 5. | Add furniture to Bldg. 25 (Residence). |
| 6. | Confirm Transformer #1 at Bldg. 2 (Office) can be shot out prior to exercise. |
| 7. | Add 3 OPFOR in Bldg. 25 (Residence). 1 live OPFOR on desk-top. 1 is armed civilian. 1 dead OPFOR. |
| 8. | Add 1 "police officer" (RBD soldier_dcu) located outside at the NE corner of Bldg. 23 (Hotel). Police officer will move inside Bldg. 23 (Hotel) when 2d Squad arrives within 10 meters. |
| 9. | Add 2 civilians on the battlefield (COBs) as hostages in Bldg. 25 (Residence). |
| 10. | Add crowd in front of Bldg 15 (Fire Station). Crowd will disperse away from the squad as it approaches. |
| 11. | DISAF 3d Squad fire team visible at Checkpoint #2. |
| 12. | Cultural objects added |

Scenario: This scenario takes place at night. The operation order has been issued by the platoon leader. The scenario begins with the 2d Squad at the 2d PLT command post in Bldg. 3 (Warehouse). 3 armed OPFOR have seized hostages and are located in Bldg. 25 (Residence) (3 OPFOR will be positioned in Building 25 – 1 live desk-top, 1 armed civilian, and 1 dead OPFOR). 2 COBs are being held hostage. A local police officer (RBD soldier_dcu) is placed at

NE corner of Bldg 23 (Hotel). The 2d Squad is ordered to conduct a deliberate attack to free the hostages in Bldg. 25 (Residence). To accomplish this, the 2d Squad must follow ROUTE REAPER to Bldg. 2 (Office), shoot out the transformer located there, continue along ROUTE REAPER shooting out street light #2, if necessary, then move to an assault position on the North side of Bldg. 23 (Hotel) to begin its assault on Bldg. 25 (Residence). The platoon leader:

- (1) Confirms enemy location as Bldg. 25 (Residence).
- (2) Reinforces order of no final assault in the direction of Bldg. 25 (Residence) until after the transformer and street light #2 are shot out.
- (3) The squad leader is told he will be issued smoke, fragmentation, and flashbang grenades, hand-launched signal flares, and two satchel charges. Per the unit SOP, the hand-launched signal flares are for night visibility (white parachute), identification (yellow parachute), lifting and shifting fires (green parachute), and cease fire (red parachute).
- (4) Use satchel charge to gain entry into Bldg 25 (Residence).
- (5) Use any color smoke grenades except red to cover his final assault. Red smoke is universal cease fire signal.
- (6) The 2d Squad Leader will not employ smoke grenades without coordinating wind direction with the platoon leader.
- (8) The squad will use flashbang grenades to help clear rooms.

The squad will form up to the East of Bldg 23 (Hotel) and move along ROUTE BLUE unmolested. The squad must shoot out transformer #1 and streetlight #2 to avoid silhouetting its movement. The squad leader should not use smoke grenades to cover his movements because of the adverse wind direction. The squad leader should report when he arrives at the assault position, commences the assault, and when his mission is completed. If the squad leader does not report, the platoon leader will ask for repeated SITREPs. ENDEX will occur when the mission is accomplished or when the squad can no longer perform its mission.

Scenario # 7A: Deliberate Attack

Mission Briefing

Your unit is always the 2d Squad of the 2d Platoon.

Enemy Situation: Enemy presence is considered light, capable of conducting military operations with forces less than squad-size. There is no mechanized or motorized or indirect fire threat. Last reported enemy activity in the region was a squad-sized raid conducted in the neighboring town of Polo, 8 kilometers to the northwest, 2 nights ago. The town population of Dlubac (pronounced d-lü-běk) is considered to be friendly. However, there may be insurgents and insurgent sympathizers within the town's population.

Mission of Higher Units: 1st and 3d Platoons have established roving patrols throughout the local territory to counter any enemy movement in the region. 2d Platoon, your platoon, is the company reserve located in the town of Dlubac. The town is considered to be friendly. Town security has been left up to the regional militia forces cordoning the town with local patrols. They are located outside the town limits. 2d Platoon has established a visible presence in the town. 1st SQD is manning Checkpoint #1 on the road entrance adjacent to Bldg. 4 (Power House) at the northeast corner of the town. 3d SQD is manning Checkpoint #2 on the road entrance adjacent to Bldg. 23 (Hotel) at the southern corner of the town. 2d SQD, your squad, is the platoon reserve located in Bldg 1 (Factory). The 1st SQD reported that a COB had observed two men entering Bldg 7 (Residence), armed with rifles. When a fire team from the 1st SQD went to investigate, they came under attack. That fire team has established a supporting fire position at the southwest corner of Bldg 4, the Power Station.

Your Mission: 2d SQD is to conduct a deliberate attack of Bldg 7 (Residence) using the supporting fires from 1st Squad to assist its attack. Your start point is Bldg 1 (Factory). Use ROUTE DRAGON to conduct your assault. Establish a support-by-fire position along the road at the south side of Bldg 12 (City Hall). You will be issued smoke, fragmentation, and flashbang grenades, hand-launched signal flares, and satchel charges. Per the unit SOP, the hand-launched signal flares are for night visibility (white parachute), identification (yellow parachute), lifting and shifting fires (green parachute), and cease fire (red parachute). Use a satchel charge to gain entry into Bldg 7 (Residence). Use any color smoke grenades except red to cover your final assault. Both red smoke and red parachute flares are the universal cease fire signal. Check wind direction with me prior to using any smoke. Use flashbang grenades to help clear rooms. Use parachute flares to lift and shift fires from the 1st SQD fire team and verbal communications with your support team to shift their fires. Use smoke to cover your assault team's attack on Bldg 7 (Residence). You will report your departure from the CP, establishing the support-by-fire position, when you begin your initial assault, and final status. Is that clear?

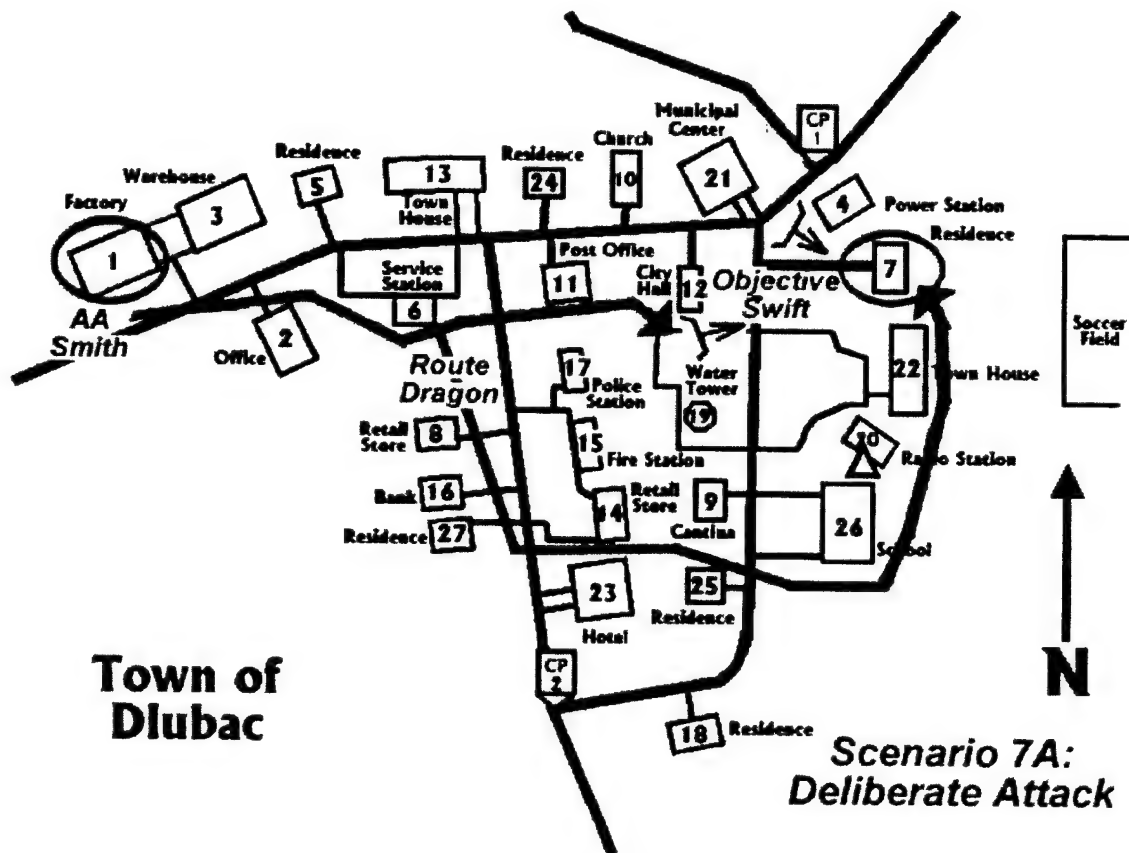
Rules of Engagement: Since the overall population of Dlubac is considered friendly, the rules of engagement are very restrictive. There will be no weapon firing within the town limits except in self-defense or at confirmed enemy targets. Enemy targets must be positively identified. Self-defense is defined as a serious threat to life or limb. A serious threat is considered gunfire or the

presence of an uncontrolled mob armed with life-threatening weapons such as knives, pikes, metal poles, etc. Weapons control status is tight.

Your immediate task is to brief your squad members and organize the squad to conduct the attack. Call signs remain constant.

What are your questions?

The scenario will begin once you have briefed your subordinates and the patrol is preparing to deploy from the platoon CP location.



Scenario Description

| Scenario Set-Up and Demonstrated Technologies | | |
|--|----------------------------------|---|
| Time of Day: First Light 0615 | Technologies | |
| Weather: Clear | Crowd Behavior | |
| Wind effect: 4 kph | Armed Civilian | |
| Wind direction: From South | Follow Me/IC Station Keeping | X |
| Exterior Lighting: Off | Smoke Grenade | X |
| | Stun/Flashbang Grenade | X |
| | Hand Emplaced/Satchel Charge | X |
| | Hand-Launched Signal Flares | X |
| | After-Action Review (AAR) System | X |

The unit is always the 2d Squad of the 2d Platoon.

Mission Overview: The 1st and 3d Platoons have established patrols throughout the local territory to counter any enemy movement in the region. The 2d PLT is the company reserve located in the town of Dlubac (pronounced d-lü-běk). The town is considered friendly. Town security has been left up to the regional militia forces cordoning the town with local patrols. They are located outside the town limits. 2d Platoon has established a visible presence in the town. 1st Squad is manning Checkpoint #1 on the road entrance adjacent to Bldg 4 (Power House) at the northeast corner of the town. 3d Squad is manning Checkpoint #2 on the road entrance adjacent to Bldg 23 (Hotel) at the southern corner of the town. The 2d Squad is the platoon reserve located in Bldg 1, the Factory. The 1st Squad, manning Checkpoint #1, reported that a COB had observed two men entering Bldg 7 (Residence), armed with rifles. When a fire team from the 1st Squad went to investigate, they came under attack. That fire team has established a supporting fire position at the Southwest corner of Building 4, the Power Station. The platoon leader orders 2d Squad to conduct a deliberate attack using the supporting fires from 1st Squad to assist its attack.

| Prior to Beginning Scenario | |
|------------------------------------|--|
| 1. | Start point is Bldg 1 (Factory). Objective is Bldg. 7 (Residence). |
| 2. | Add DISAF civilian on the battlefield (COB) moving through Checkpoint #1. CIV will stop to talk to soldier manning checkpoint. |
| 3. | Add DISAF COB at Checkpoint #1. CIV will run from Checkpoint #1 to Building 24 (Residence) when movement begins. |
| 4. | Add DISAF 1st Squad fire team at Checkpoint #1. Moves defensively when firing starts. |
| 5. | Add DISAF 3d Squad fire team at Checkpoint #2. |
| 6. | Add furniture to Bldg 7 (Residence) |
| 7. | Add rubble to Building 7 (Residence). |
| 8. | 2 OPFOR in Bldg 7 (Residence). 1 OPFOR is on desk-top. 1 OPFOR DISAF. |
| 9. | DISAF 1st Squad fire team provides support by fire positions. |
| 10. | Cultural objects added. |

Scenario: This scenario takes place at first light. The scenario begins with the 2d Squad at the 2d Platoon command post in Bldg 1 (Factory). As part of his OPOD, the 2d Platoon Leader states that:

(1) A fire team from 1st Squad got into a firefight when it went to investigate two men armed with rifles entering Bldg 7 (Residence).

(2) Directs the 2d Squad conduct a deliberate attack on Bldg 7 (Residence) (OBJ SWIFT).

(3) Use ROUTE DRAGON.

(4) Establish a support-by-fire position along the road at the south side of Bldg 12 (City Hall).

(5) Use green parachute flare to lift and shift fires with 1st Squad fire team and verbal communications to shift fires from the from your support team.

(6) Use smoke to cover the assault team's attack on Bldg 7 (Residence).

(7) Use satchel charge to enter Bldg 7 (Residence).

(8) Use flashbang grenades to clear rooms.

(9) The squad leader can use any color smoke grenades except red to cover assault, but check wind direction with the platoon leader prior to using smoke; red smoke is universal cease fire signal.

The squad leader should report his departure, establishing the support-by-fire position, his initial assault, and final status. If the squad leader does not report, the platoon leader will ask for a SITREP. ENDEX will occur when the mission is accomplished or when the squad can no longer perform its mission.

Scenario # 7B: Deliberate Attack

Mission Briefing

Your unit is always the 2d Squad of the 2d Platoon.

Enemy Situation: Enemy presence is considered light, capable of conducting military operations with forces less than squad-size. There is no mechanized, motorized, or indirect fire threat. Yesterday, the enemy made a concerted attack against the neighboring town of Rio, eight kilometers north of Dlubac (pronounced d-lü-běk). Enemy forces were beaten back with heavy losses. The remaining forces are seeking cover in the neighboring area, including Dlubac. The town population is considered to be friendly. However, surviving insurgents and insurgent sympathizers are located within the town.

Mission of Higher Units: Company B, your company, has secured the town of Dlubac. The 1st and 3d PLTs have established blocking positions north of the town to prevent enemy infiltration from the enemy attack on Rio. 2d PLT, your platoon, is the company reserve located in the town. 1st SQD is manning Checkpoint #1 on the road entrance adjacent to Bldg. 4 (Power House) at the northeast corner of the town. 3d SQD is manning Checkpoint #2 on the road entrance adjacent to Bldg. 23 (Hotel) at the southern corner of the town. 2d SQD, your squad, is the platoon reserve located in Bldg 7 (Residence). A local police officer reported observing two men entering Bldg 2 (Office), armed with rifles.

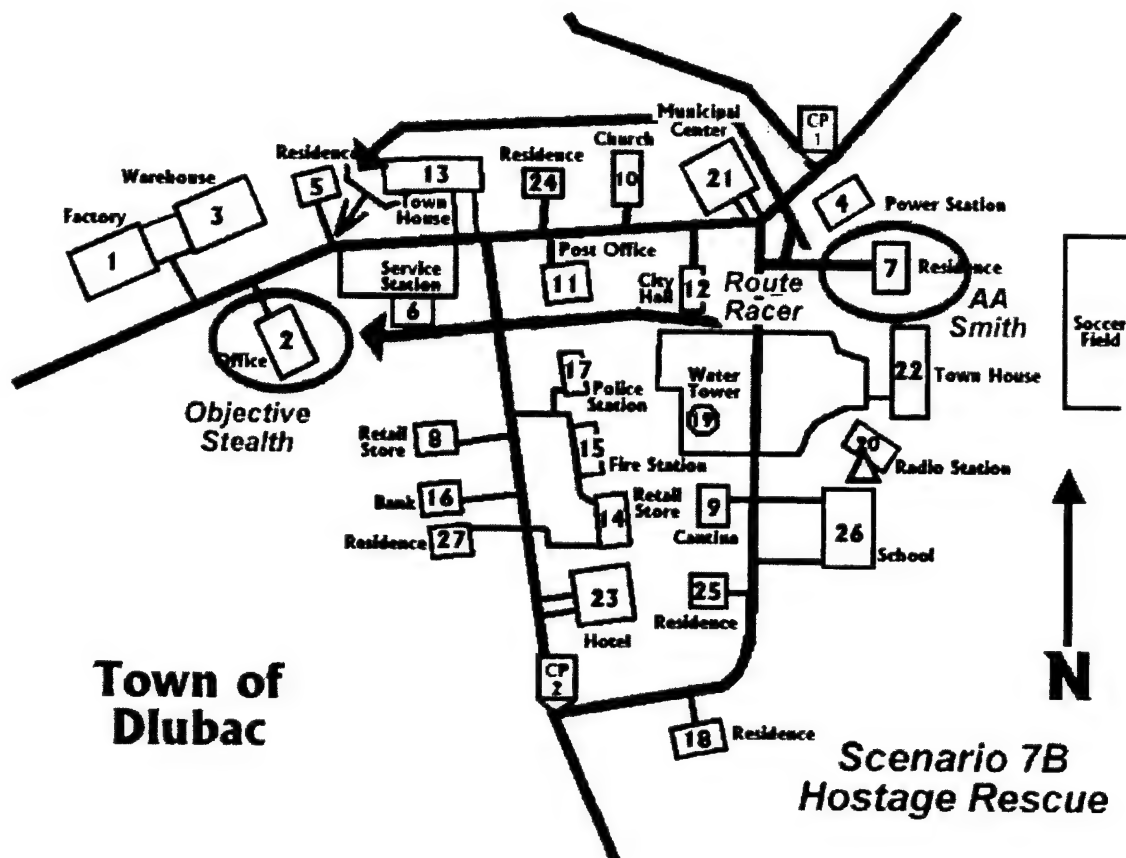
Your Mission: 2d Squad is to conduct a deliberate attack on Bldg 2 (Office) (OBJ STEALTH). Your start point is Bldg 7 (Residence). You will use ROUTE RACER to conduct your assault. You will establish a fire support position at fire support position Alpha using Alpha Team in and around Bldg 5 (Residence). You will be issued smoke, fragmentation, and flashbang grenades, hand-launched signal flares, and satchel charges. Per the unit SOP, the hand-launched signal flares are for night visibility (white parachute), identification (yellow parachute), lifting and shifting fires (green parachute), and cease fire (red parachute). Use a satchel charge to gain entry into Bldg 2 (Office). Use any color smoke grenades except red to cover your final assault; both red smoke and red parachute flares are the universal cease fire signal. Check wind direction with me prior to using any smoke. Use flashbang grenades to help clear rooms. You will report your departure from the CP, establishing the support-by-fire position, when you begin your initial assault, and final status.

Rules of Engagement: Terrorist forces are located within the town. However, the overall town population is considered to be friendly. As a result, the rules of engagement are very restrictive. There will be no weapon firing within the town except in self-defense or in defense of the town against a confirmed enemy presence. Self-defense is defined as a serious threat to life or limb. Weapons control status is tight.

Your immediate task is to brief your squad members and organize the squad for movement. Call signs remain constant.

What are your questions?

The scenario will begin once you have briefed your subordinates and you are prepared to execute the mission.



Scenario Description

| Scenario Set-Up and Demonstrated Technologies | | |
|---|----------------------------------|---|
| Time of Day: 0700 | Technologies | |
| Weather: Clear | Crowd Behavior | |
| Wind effect: 2 kph | Armed Civilian | |
| Wind direction: From West | Follow Me/IC Station Keeping | X |
| Exterior Lighting: Off | Smoke Grenade | X |
| | Stun/Flashbang Grenade | X |
| | Hand Emplaced/Satchel Charge | X |
| | Hand-Launched Signal Flares | X |
| | After-Action Review (AAR) System | X |

The unit is always the 2d Squad of the 2d Platoon.

Mission Overview: 1st and 3d PLTs have responded to sightings of enemy forces moving throughout the local area. The 2d PLT is the company reserve located in the town of Dlubac

(pronounced d-lü-běk). The town is considered a friendly town. 1st Squad is manning Checkpoint #1 on the road entrance adjacent to Bldg. 4 (Power House) at the northeast corner of the town. 3d Squad is manning Checkpoint #2 on the road entrance adjacent to Bldg. 23 (Hotel) at the southern corner of the town. The 2d Squad is the platoon reserve located in Bldg. 7, Residence. A local police officer observed two men entering Bldg. 2 (Office), armed with rifles. The platoon leader orders 2d Squad to conduct a deliberate attack.

| Prior to Beginning Scenario | |
|-----------------------------|---|
| 1. | Start point is Bldg. 7 (Residence). Objective is Bldg. 2 (Office). |
| 2. | Add rubble to Building 13 (Town House) and Bldg. 6 (Service Station). |
| 3. | Add DISAF fire team at Checkpoint #1. Moves defensively if firing starts. |
| 4. | Add furniture to Bldg. 2 (Office). |
| 5. | Add bus coming from Checkpoint #2 to Building 10 (Church). |
| 6. | Add 2 DISAF civilians on the battlefield (COBs) moving through Checkpoint #1. One will stop to talk to soldier manning checkpoint. One will move to Building 3 (Warehouse). |
| 7. | 3 OPFOR in Bldg. 2 (Office). 1 OPFOR is desk-top. 2 OPFOR DISAF. |
| 8. | Cultural objects added. |

Scenario: This scenario takes place early morning. The scenario begins with the 2d Squad at the 2d Platoon command post in Bldg. 7 (Residence). As part of his OPORD, the 2d Platoon Leader states that:

- (1) A local policeman observed two men armed with rifles entering Bldg. 2 (Office)
- (2) Directs the 2d Squad conduct a deliberate attack on Bldg. 2 (Office) (OBJ

STEALTH)

- (3) Use ROUTE RACER
- (4) Establish a support-by-fire position in and around Bldg. 5 (Residence)
- (5) Use parachute flares to lift and shift fires between teams.
- (6) Use smoke to cover the assault team's attack on Bldg. 2 (Office)
- (7) Use satchel charge to enter Bldg. 2 (Office)
- (8) Use flashbang grenades to clear individual rooms.

The squad leader should report his departure, establishing the support-by-fire position, his initial assault, and final status. If the squad leader does not report, the platoon leader will ask for a SITREP. ENDEX will occur when the mission is accomplished or when the squad can no longer perform its mission.

Scenario # 10: Crowd Control

Mission Briefing

Your unit is always the 2d Squad of the 2d Platoon.

Enemy Situation: Enemy forces have withdrawn from the town of Dlubac (pronounced d-lü-běk). There may still be insurgents and insurgent sympathizers within the town's population. Enemy presence is considered light, capable of conducting military operations with less than squad-size forces. There is no mechanized, motorized, or indirect fire threat. Last reported enemy activity in the region was sniper fire in the neighboring town of Tuskin, 8 kilometers to the northwest, 3 days ago.

Mission of Higher Units: The company has occupied the town of Dlubac. 1st and 3d Platoons have established patrol bases outside the town to prevent infiltration by enemy forces. 2d PLT is the company reserve. Its mission is to establish a presence within the town. 1st SQD is at Checkpoint #1 on the northeast side of town adjacent to Bldg 4 (Power Station). 3d SQD just finished conducting a roving patrol of the town and is back at Checkpoint #2 at the southern end of town. 2d SQD is the platoon reserve located at the platoon command post (CP) in Bldg 26 (School). 3d SQD reports that a crowd of approximately 10 persons has formed in front of Bldg 6 (Service Station). No weapons have been reported. The crowd is getting agitated and has already set a car on fire. A 1st SQD fire team has taken up an overwatch position at the road intersection at Bldg 13 (Town House) at OBJECTIVE DRY.

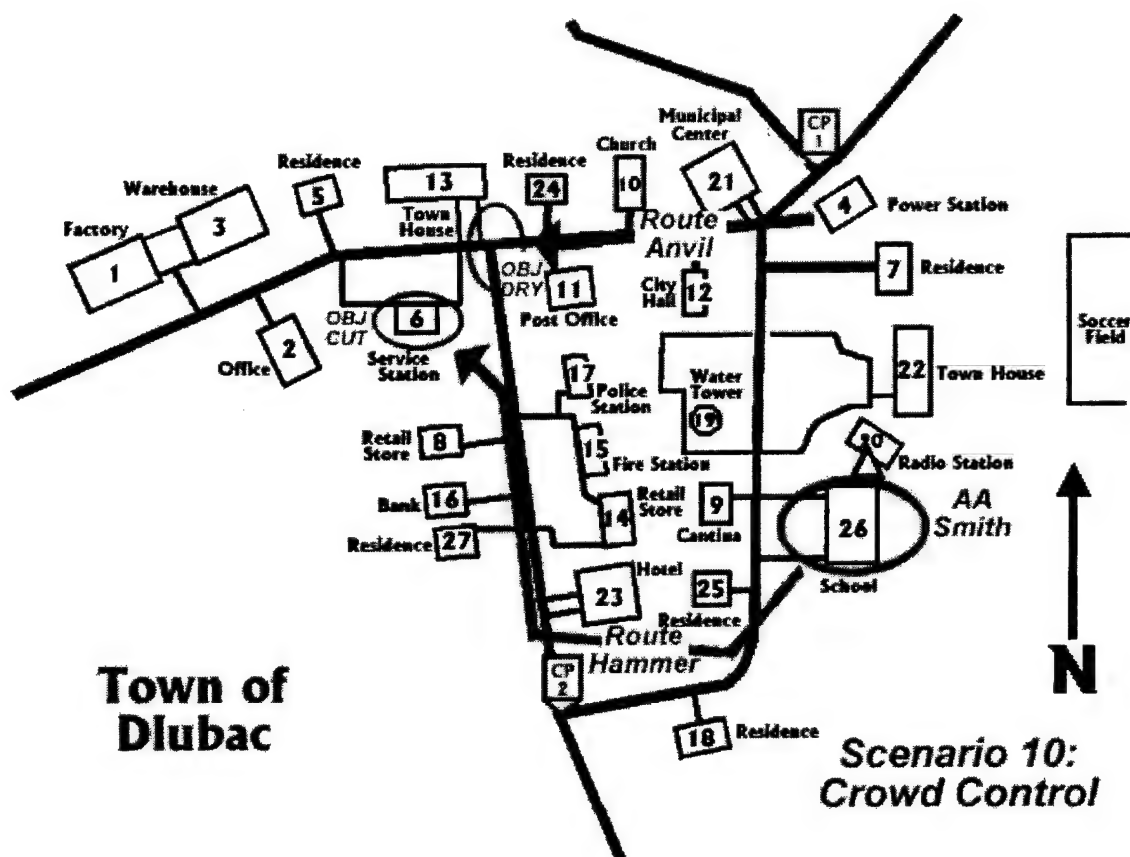
Your Mission: 2d Squad, your squad, is to execute a show of force and report on the activities of the crowd. Your start point is Bldg. 26 (School). You will move along ROUTE HAMMER to conduct your movement to Bldg 6 (Service Station) OBJECTIVE CUT. You will form on-line using Bldg 6 in the center as a base, preventing the crowd from moving South, deeper into the town. A 1st SQD fire team is already located to the east, at the intersection of Bldgs 13 (Town House) and 11 (Post Office). You will be issued smoke, fragmentation, and flashbang grenades, hand-launched signal flares, and satchel charges. Per the unit SOP, the hand-launched signal flares are for night visibility (white parachute), identification (yellow parachute), lifting and shifting fires (green parachute), and cease fire (red parachute). Remember, red smoke and red parachute flares are the universal cease fire signals. Check wind direction with me prior to using any smoke. You will use flashbang grenades to help clear the streets, if necessary, and only on my order. You will report your departure from the CP, your arrival at Bldg 6 (Service Station), and the activities of the crowd.

Rules of Engagement: Since the overall town population of Dlubac is considered friendly, the rules of engagement are very restrictive. There will be no weapon firing within the town except in self-defense or in defense of the town against a confirmed enemy presence. Self-defense is defined as a serious threat to life or limb. A serious threat is considered gunfire or the presence of an uncontrolled mob armed with life-threatening weapons such as knives, pikes, metal poles, etc. Every effort must be made to disarm the situation prior to the use of deadly force. Weapons control status is tight.

Your immediate task is to brief your squad members and organize the squad to move to OBJECTIVE CUT. Call signs remain constant.

What are your questions?

The scenario will begin once you have briefed your subordinates and the patrol is preparing to deploy from the platoon CP location.



Scenario Description

| Scenario Set-Up and Demonstrated Technologies | | |
|---|----------------------------------|---|
| Time of Day: Noon | Technologies | |
| Weather: Clear | Crowd Behavior | X |
| Wind effect: 5 kph | Armed Civilian | |
| Wind direction: From NW | Follow Me/IC Station Keeping | X |
| Exterior Lighting: Off | Smoke Grenade | X |
| | Stun/Flashbang Grenade | X |
| | Hand Emplaced/Satchel Charge | |
| | Hand-Launched Signal Flares | |
| | After-Action Review (AAR) System | X |

The unit is always the 2d Squad of the 2d Platoon.

Mission Overview: The company has occupied the town of Dlubac (pronounced d-lü-běk). 1st and 3d PLTs have established patrol bases outside the town to prevent infiltration by enemy soldiers. 2d PLT is the company reserve. Its mission is to establish a presence. 1st SQD is at Checkpoint #1 on the northeast side of town adjacent to Bldg 4 (Power Station). 3d SQD just completed a roving patrol of the town and has re-established Checkpoint #2 at the southern end of town. 2d SQD is the platoon reserve located at the platoon command post (CP) in Bldg 26 (School). 3d SQD reports that a crowd of approximately 10 persons has formed in front of Bldg 6 (Service Station). No weapons have been reported. The crowd is getting agitated and has already set a car on fire. The PLT LDR has a fire team from 1st SQD take up an overwatch position at the road intersection at Bldg 13 (Town House).

| Prior to Beginning Scenario | |
|-----------------------------|--|
| 1. | Start point is Bldg 26 (School). Objective is Bldg 3 (Warehouse). |
| 2. | All interior lights are on in buildings. |
| 3. | Add rubble to Building 6 (Service Station) and Bldg 5 (Residence). |
| 4. | Add 2 live OPFOR in Building 3 (Warehouse). 1 is live OPFOR on desktop, other is DISAF. DISAF OPFOR must be on hold-fire until EXFOR advances. |
| 5. | Add burning car in street north of Building 6 (Service Station) vicinity of crowd. |
| 6. | Add SAF 1st Squad fire team at Checkpoint #1. |
| 7. | Add SAF 3d Squad fire team at Checkpoint #2. |
| 8. | Establish two COBs crowds of 6 personnel each. Combine crowds in street north of Building 6 (Service Station). |
| 9. | Add SAF 1st Squad fire team located to the east of crowd at the intersection of Buildings 13 (Town House) and 11 (Post Office). |
| 10. | Send 1 crowd west along the road, then disperse when fired upon. |
| 11. | Desktop OPFOR will fire 3 shots as crowd moves toward Building 3 (Warehouse) |
| 12. | Add furniture to inside of Bldg 3. (Warehouse). |
| 13. | Identify role player for 1st Squad Leader communications reports. |
| 14. | Cultural objects added. |

Scenario: The scenario is run at noon. The scenario begins with 2d SQD at the PLT command post (CP) in Building 26 (School). The PLT LDR directs 2d SQD to approach the intersection via ROUTE Hammer to Bldg 6 (Service Station) OBJ CUT. The platoon leader intends for a show of force. A fire team from 1st Squad is already located to the east, at the intersection of Bldgs 13 (Town House) and 11 (Post Office) at OBJ DRY. As the 2d SQD arrives, the crowd divides with one group staying around the burning car. The second group starts moving west along the main street. (The squad leader should report both 2d SQD's arrival on site and the movement of the crowd to the PLT LDR. If the squad leader does not report, the 1st SQD LDR will make the report to the platoon leader.) The platoon leader will direct the 1st SQD to remain in place and observe the group of civilians at the burning car. 2d SQD is to keep the departing group under observation, paralleling its movement by about 50 meters. As the 2d SQD nears Bldg 3 (Warehouse), they come under fire from 2 OPFOR. The crowd disperses into adjacent buildings at the sound of the gunfire. The squad leader should report this situation to the platoon

leader. If the squad leader does not report, the platoon leader will ask for a SITREP.) The platoon leader:

- (1) Orders the squad to close with and destroy the enemy.
- (2) Tells the squad leader to use smoke to cover his movement
- (3) Use flashbang grenades to clear individual buildings and rooms once inside the building.

The squad maneuvers to and assaults the building. The squad must kill the 2 OPFOR snipers. ENDEX will occur when the mission is accomplished or when the squad can no longer perform its mission.

Scenario # 11: Downed Helicopter

Mission Planning Briefing

Your unit is always the 2d Squad of the 2d Platoon.

Enemy Situation: Enemy forces have withdrawn from the town of Dlubac (pronounced d-lü-běk). The town population is considered to be friendly. However, there may be insurgents and insurgent sympathizers within the town's population. Last reported enemy activity in the region was the laying of mines on the road leading to the town of Ursula, 6 kilometers to the west. Enemy presence was less than squad-size.

Mission of Higher Units: The company has occupied Dlubac. The CO CDR has ordered the platoons to establish a defense along the perimeter of the town. 3d PLT has established its sector along the north and east from Bldg. 1 (Factory) to Bldg. 22 (Townhouse). 1st PLT has established its sector in the south and west from Bldg. 26 (School) to Bldg. 2 (Office). The 2d PLT, your platoon, is the company reserve. The 2d PLT's mission is to maintain the peace and order within the town. To accomplish this, the platoon has established two checkpoints. 1st Squad is at Checkpoint #1 on the northeast side of town to control movement into and from the town. 3d Squad is at Checkpoint #2 at the southern end of the town and is conducting a roving patrol along the interior road network.

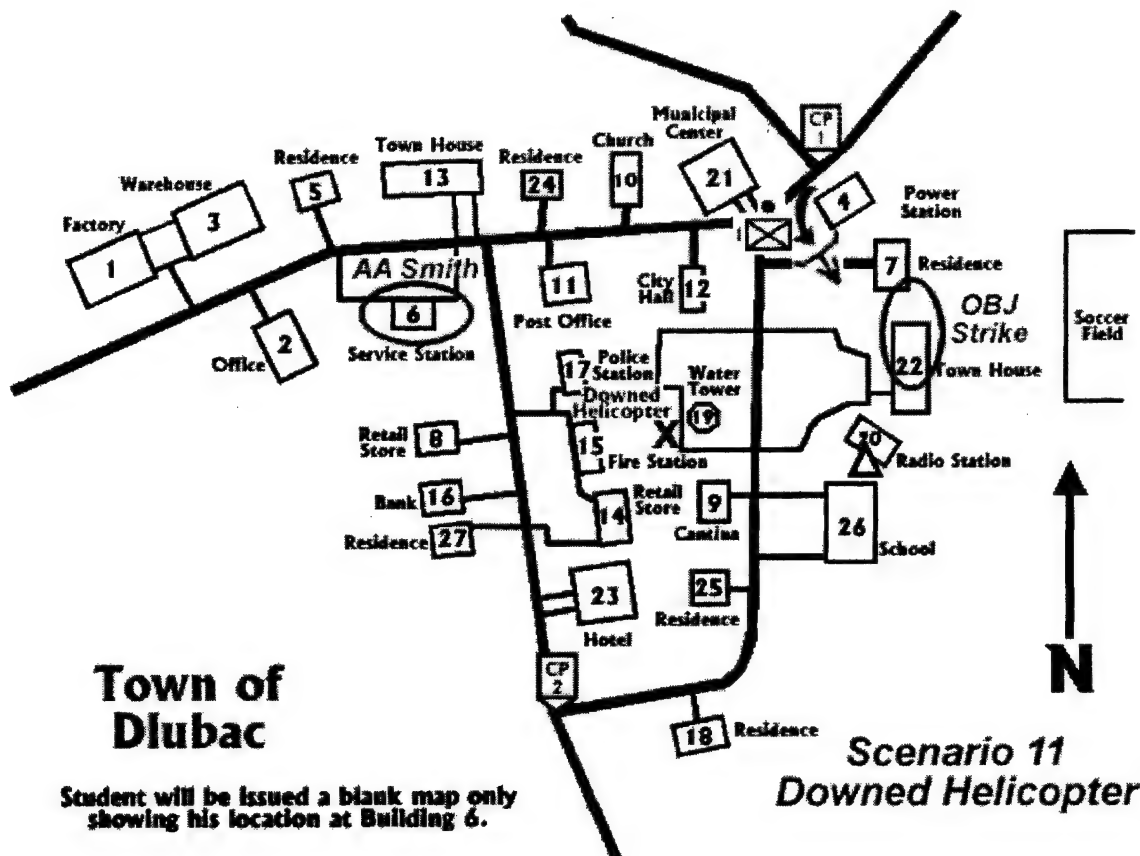
Your Mission: 2d Squad, your squad, is the platoon reserve located at the platoon command post in Bldg. 6 (Service Station). Per your unit SOP, you will carry smoke, fragmentation, and flashbang grenades, hand-launched signal flares, and satchel charges. Remember, per the unit SOP, the hand-launched signal flares are for night visibility (white parachute), identification (yellow parachute), lifting and shifting fires (green parachute), and cease fire (red parachute). Also remember that both red smoke and red parachute flares are the universal cease fire signals. Always check wind direction with me prior to using any smoke.

Rules of Engagement: Since the overall population of Dlubac is considered friendly, the rules of engagement are very restrictive. There will be no weapon firing within the town limits except in self-defense or in defense of the town against a confirmed enemy presence. Enemy targets must be positively identified. Self-defense is defined as a serious threat to life or limb. A serious threat is considered gunfire or the presence of an uncontrolled mob armed with life-threatening weapons such as knives, pikes, metal poles, etc. Every effort must be made to disarm the situation prior to the use of deadly force. Weapons control status is tight.

Your immediate task is to brief your squad members on the current situation. Call signs remain constant.

What are your questions?

The scenario will begin once you have briefed your subordinates and the patrol is preparing to deploy from the platoon CP location.



Scenario Description

| Scenario Set-Up and Demonstrated Technologies | | |
|---|----------------------------------|---|
| Time of Day: Day 0900 | Technologies | |
| Weather: Light rain | Crowd Behavior | X |
| Wind effect: 5 kph | Armed Civilian | |
| Wind direction: From East | Follow Me/IC Station Keeping | X |
| Exterior Lighting: Off | Smoke Grenade | X |
| | Stun/Flashbang Grenade | X |
| | Hand Emplaced/Satchel Charge | X |
| | Hand-Launched Signal Flares | X |
| | After-Action Review (AAR) System | X |

The unit is always the 2d Squad of the 2d Platoon.

Mission Overview: The company has secured the town of Dlubac (pronounced d-lü-bëk). The company commander has ordered the platoons to establish a defense along the perimeter of the town. 3d PLT has established its sector along the north and east sides of the town from Building 1 (Factory) to Building 22 (Townhouse). 1st PLT has established its sector in the south and west sides of the town from Building 26 (School) to Building 2 (Office). 2d PLT is the company reserve. 3d Squad is manning Checkpoint #2 on the south side of town to control movement into and from the town and conduct a squad-sized roving patrol to establish a presence. 1st SQD is

manning Checkpoint #1. 3d SQD is also conducting the roving patrol along the interior road network. 2d SQD is the platoon reserve located at Bldg 6 (Service Station). The platoon mission is to maintain the peace and order within the town. All indirect fires and MEDEVAC vehicles are requested through the platoon leader. The ROE is restrictive - only return fire after fired upon.

| Prior to Beginning Scenario | |
|------------------------------------|--|
| 1. | Start Point is Bldg. 6 (Service Station). Objective is Bldg. 22 (Town House). |
| 2. | Add furniture to 1st apartment on North side of Bldg. 22 (Town House). |
| 3. | All interior lights are on in buildings. |
| 4. | SAF fire team from 1st Squad is at Checkpoint #1. |
| 5. | SAF fire team from 3d SQD moving from Building 10 (Church) to BLDG 23 (Hotel), then move into Building 18 (Residence). |
| 6. | Loud explosion can be heard while 2d Squad is in Bldg 6 (Service Station). |
| 7. | SAF fire team from 1st Squad moves from inside BLDG 4 to on-line fire-by-support positions West of Bldg. 7 (Power Station) – on order execute movement. |
| 8. | Add burning helicopter crashed west of, but adjacent to, the water tower. |
| 9. | Add 5 prone (injured and dead) friendly SAF personnel lying on the ground on the west side of the helicopter. |
| 10. | Add crowd surrounding downed helicopter, milling around. Crowd disperses when squad reaches to within 50 meters of downed helicopter. |
| 11. | Add 1 OPFOR Sniper in northern apartment in Building 22 (Town House). OPFOR is on desktop. |
| 12. | Add rubble to Buildings 9 (Cantina), 26 (School), 20 (Radio Station), and 22 (Town House). |
| 13. | Add SAF Medic to 2d Squad at Service Station. He will accompany squad to the downed helicopter. A role player must be identified to portray Medic calling squad leader on radio to report "that there are 3 injured and 2 dead friendly personnel present. Request MEDEVAC immediately." He must also stand by to respond to a radio call from squad leader reporting that the MEDEVAC is en route, ETA is 10 minutes" and give a "Roger out." |
| 14. | Identify role player to replicate 1st SQD LDR responding to PLT LDR and when reporting his unit in position to 2d SQD LDR. |
| 15. | Cultural objects added. |

Scenario: This scenario takes place early morning. The operation order has been issued by the platoon leader. The scenario begins with the 2d Squad at the platoon command post in Bldg 6 (Service Station). A loud explosion breaks the silence. The platoon leader calls the 2d Squad Leader and informs him that a Blackhawk Helicopter has crashed just outside next to the water tower behind Building 17 (Police Station). He orders the 2d Squad to secure the downed helicopter. The medic will join the 2d Squad as the squad moves past Bldg 17 (Police Station). The downed helicopter will be crashed on the northwest side of the water tower with fire and smoke present. As squad arrives, a civilian crowd surrounding the area disperses away from the squad. 5 friendly personnel (3 injured, 2 dead) are visible lying on the ground on the western side of the helicopter. The squad will be issued smoke, fragmentation, and flashbang grenades, hand-launched signal flares, and satchel charges. Per the unit SOP, the hand-launched signal

flares are for night visibility (white parachute), identification (yellow parachute), lifting and shifting fires (green parachute), and cease fire (red parachute). He is cautioned that both red smoke and red parachute flares are the universal cease fire signal. Check wind direction with the platoon leader prior to using any smoke. Once the squad reaches the crash site, the SAF medic immediately moves to and around the helicopter crew. He gets on a radio and states that there are 3 injured and 2 dead friendly personnel present. He asks for help treating the injured personnel and tells the squad leader that a MEDEVAC is needed ASAP. If the squad leader fails to report his arrival on site or fails to request a MEDEVAC, the platoon leader asks for a SITREP. The platoon leader states that a MEDEVAC is enroute, estimated time of arrival (ETA) is 10 minutes.

After the conversation ends, 1 OPFOR in Building 22 (Town House) starts sniping at the 2d SQD for the 1st apartment in the north. If the squad leader fails to report, the platoon leader asks for a SITREP. The PLT LDR directs the 2d Squad to initially remain in place, protect the injured personnel, and orient fires on the sniper. He states that a fire team from 1st Squad will move to provide support from a support-by-fire position on the west side of Bldg. 4 (Power Station). Once the 1st Squad fire team arrives, 2d SQD will assault and clear Bldg. 22 (Town House). 2d Squad is to use the green parachute flares to lift and shift fires with the 1st SDQ element. The 1st SQD fire team will call for instructions once they are in position. This scenario will allow free play for friendly movement. ENDEX will occur when the mission is accomplished or when the squad can no longer perform its mission.

Scenario # 13: Assault/Clear Building (Wall)

Mission Planning Briefing

Your unit is always the 2d Squad of the 2d Platoon.

Enemy Situation: Enemy forces have seized the town of Dlubac (pronounced d-lü-běk). Enemy presence is considered light, at platoon strength. 1-4 enemy personnel have been found defending any given building. There is no mechanized, motorized, or indirect fire threat.

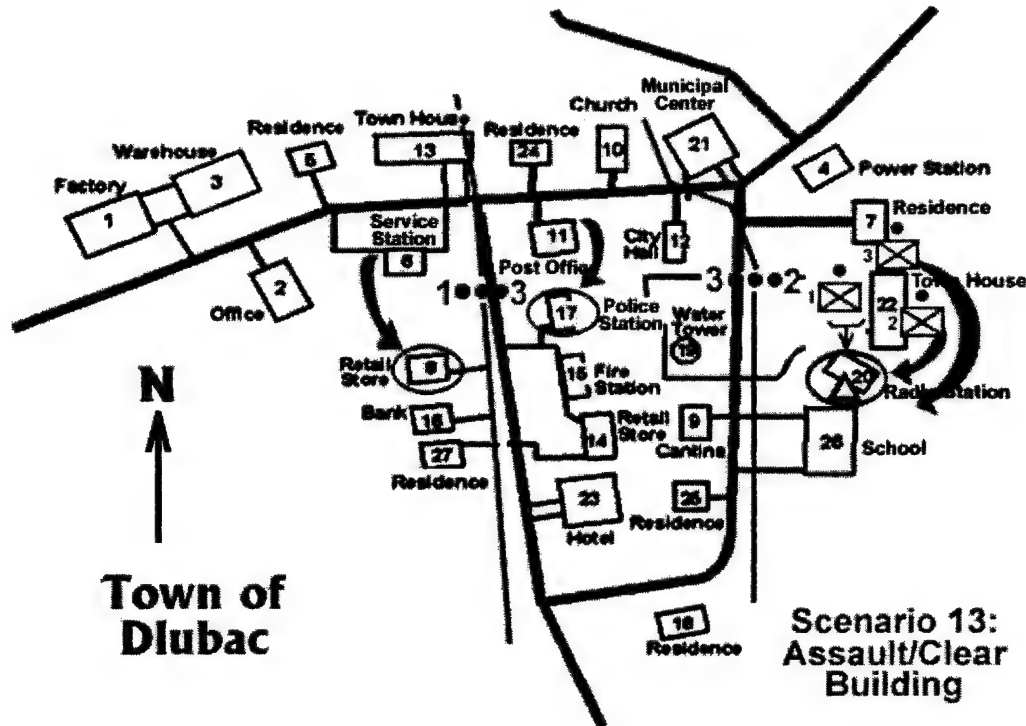
Mission of Higher Units: Your company has completed its initial assault on the town and established an overall front line trace (see map). 1st PLT is on the right in Bldg. 6 (Service Station), preparing to assault Bldgs. 8 (Retail Store), 16 (Bank), and 27 (Residence), respectively. 3d PLT, the main effort, is in the center in Bldg. 11 (Post Office) preparing to assault Bldgs. 17 (Police Station), 15 (Fire Station), 9 (Cantina), and 14 (Retail Store), respectively. 2d Platoon, your platoon, is currently in Bldg. 22 (Town House), preparing to assault Bldg. 20 (Radio Station). Resistance has been light with 2-3 enemy soldiers in any building. For the assault on Bldg. 20 (Radio Station), the 1st Squad (DI SAF) will support by fire from the vicinity of the west side of Bldg. 22 (Town House). 3d Squad is the platoon reserve. 3d Squad will follow 2d Squad on order and clear Bldg. 20 (Radio Station) or Bldg. 26 (School), respectively.

Your Mission: 2d Squad, your squad, will conduct the initial assault on Bldg. 20 (Radio Station). You will begin your movement from the east side of Bldg. 22 (Town House). Once you have cleared Bldg. 20 (Radio Station), you will provide supporting fires from the building and the area to the west to provide cover for the 3d Squad's attack on Building 26 (School). You will be issued smoke, fragmentation, and flashbang grenades, hand-launched signal flares, and satchel charges. Per the unit SOP, the hand-launched signal flares are for night visibility (white parachute), identification (yellow parachute), lifting and shifting fires (green parachute), and cease fire (red parachute). Use a satchel charge to gain entry into Bldg 20 (Radio Station). Use any color smoke grenades except red to cover your final assault; both red smoke and red parachute flares are the universal cease fire signals. Check wind direction with me prior to using any smoke. Use flashbang or fragmentation grenades to clear the rooms.

Rules of Engagement: The town population of Dlubac is considered to be friendly. However, enemy forces are located within the town. The rules of engagement are very restrictive. There will be no weapon firing within the town except in self-defense or at positively identified enemy forces. Self-defense is defined as a serious threat to life or limb. Weapons control status is tight. Your immediate task is to brief your squad members and organize the squad to complete the mission. Call signs remain constant.

What are your questions?

The scenario will begin once you have briefed your subordinates.



Scenario Description

| Scenario Set-Up and Demonstrated Technologies | | |
|---|----------------------------------|---|
| Time of Day: 1200hrs | Technologies | |
| Weather: Clear | Crowd Behavior | |
| Wind effect: 2 kph | Armed Civilian | |
| Wind direction: From NW | Follow Me/IC Station Keeping | X |
| Exterior Lighting: Off | Smoke Grenade | X |
| | Stun/Flashbang Grenade | X |
| | Hand Emplaced/Satchel Charge | X |
| | Hand-Launched Signal Flares | |
| | After-Action Review (AAR) System | X |

The unit is always the 2d Squad of the 2d Platoon.

Mission Overview: The company has completed its initial assault on the town of Dlubac (pronounced d-lü-běk) and established an overall front line trace. The company is attacking from north to south. The town is divided along the two long axes formed by the circular road network in the center of town (see map). 1st PLT is on the right in Bldg. 6 (Service Station) preparing to assault Bldgs. 8 (Retail Store), 16 (Bank), and 27 (Residence), respectively. 3d PLT, the main effort, is in the center in Bldg. 11 (Post Office) preparing to assault Bldgs. 17 (Police Station), 15 (Fire Station), 9 (Cantina), and 14 (Retail Store), respectively. 2d PLT is on the left in Bldg. 22 (Town House), preparing to assault Bldg. 20 (Radio Station). Resistance has been light (2-3

enemy soldiers in any building). The 2d PLT LDR has instructed the platoon that for the assault on Bldg 20 (Radio Station), the 1st Squad (DI SAF) will support by fire from the West side of Bldg. 22 (Town House). 2d Squad will conduct the initial assault, gain entry, and then secure Bldg. 20 (Radio Station). 1st Squad (SAF) will provide support by fire, and then become the platoon reserve. 3d Squad will follow 2d Squad; on order clear Bldg. 20 (Radio Station); then on order seizing Bldg. 26 (School). The platoon leader instructs the 2d Squad Leader that 2d Squad will be issued smoke, fragmentation, and flashbang grenades, hand-launched flares, and one satchel charge, per SOP. Per unit SOP, the flares are for visibility (white parachute), identification (yellow ground), lifting and shifting fires (green parachute), and cease fire (red parachute). The rules of engagement (ROE) restrict firing to clearly identified targets only.

| Prior to Beginning Scenario | |
|-----------------------------|--|
| 1. | Start point Bldg. 22 (Town House). Objective is Bldg. 20 (Radio Station). |
| 2. | Add furniture to Bldg. 20 (Radio Station). |
| 3. | Add 3 OPFOR in Bldg. 20 (Radio Station). 1 OPFOR is dead in preparation of the satchel charge entry blast. 1 OPFOR is desktop. 1 OPFOR is DISAF. |
| 4. | Add SAF 1st Squad fire team on the west side of Bldg. 22 (Town House) providing fire support into Bldg 20 (Radio Station). |
| 5. | Add SAF 3d Squad at north end of Bldg. 22 (Town House). Program their movement from there to seize Bldg. 26 (School). |
| 6. | Add cultural objects. |

Scenario: This scenario takes place at noon. The operation order has been issued by the platoon leader. The scenario begins with the 2d Squad in position on the east side of Bldg. 22 (Town House), preparing to assault Bldg. 20 (Radio Station). 1st Squad has established support by fire positions on the west side of the building. 3d Squad is in the rear of Bldg. 22 (Town House) as the platoon reserve. 2d Squad is preparing to conduct the assault. The squad must move across open ground to Bldg. 20 (Radio Station) under smoke and gain entry through use of a satchel charge. Once the hole is blown, 2d Squad will conduct the assault. The squad must use smoke to cover its assault. The squad must clear and secure the building. If 2d Squad is unable to clear the building, the 2d SQD LDR will call the platoon leader and ask for the 3d Squad to pass through them and continue to clear the building. If 2d Squad is successful, they will provide overwatch fires for the 3d Squad attack on Bldg. 26 (School). Bldg. 20 will be occupied by 3 OPFOR. One OPFOR will be dead as a result of the breach explosion. The squad leader must keep the platoon leader informed. If he doesn't, the platoon leader will repeatedly ask for SITREPs. ENDEX will occur when the mission is accomplished or when the squad can no longer perform its mission.

Scenario # 14: Assault/Clear Building (Roof)

Mission Planning Briefing

Your unit is always the 2d Squad of the 2d Platoon.

Enemy Situation: After a prolonged and bitter campaign, enemy forces been forced back to the town of Krasno (pronounced krāz•nō). Krasno is considered an enemy stronghold. Both their political and military infrastructure is based in the town. The town populace is extremely sympathetic to the rebel cause. Armed enemy presence is considered heavy. There is no mechanized or motorized threat. However, indirect fire, in the form of mortars is available to the enemy.

Mission of Higher Units: The 11th IN BN is conducting a combined air assault and ground assault operation to seize the town. Your company is the main effort conducting the air assault. Two other companies are conducting a simultaneous ground assault. Your CO CDR has ordered 1st PLT to conduct an air assault to seize the 10-story building. 2d PLT will simultaneously conduct an air assault to seize the 20-story high rise building. 3d PLT is the company reserve and is prepared to reinforce 2d PLT, on order. Each platoon will have four helicopters at 30-second intervals. 2d PLT LDR has ordered the 1st Squad to be the security element and will conduct the initial assault. Its mission is to secure the roof with 1 fire team and establish a toehold on the top floor of the building, clearing the steps to the 20th floor for the next squad. Access to the follow-on floors is gained by using the stairwell steps. 2d Squad is second in order. It will pass through the 1st Squad and start to clear the building, floor-by-floor. 3d Squad is to follow the 2d Squad and be prepared to assume clearing responsibilities on order. Once 2d and 3d Squads have passed through, the 1st Squad will follow 3d Squad as the platoon reserve. 1st Squad will be prepared to assume clearing duties, on order. Each squad will leave 2 men on each floor that it clears to secure that floor. The platoon command post will initially be in the shed on the roof of the building. No fires will be placed into the adjacent 10-story building unless a target is positively identified firing on the 2d Platoon. If enemy troop movement is noticed in the 10-story building, the platoon leader will be notified immediately. Even then, coordination must be obtained from the platoon leader to fire into that building.

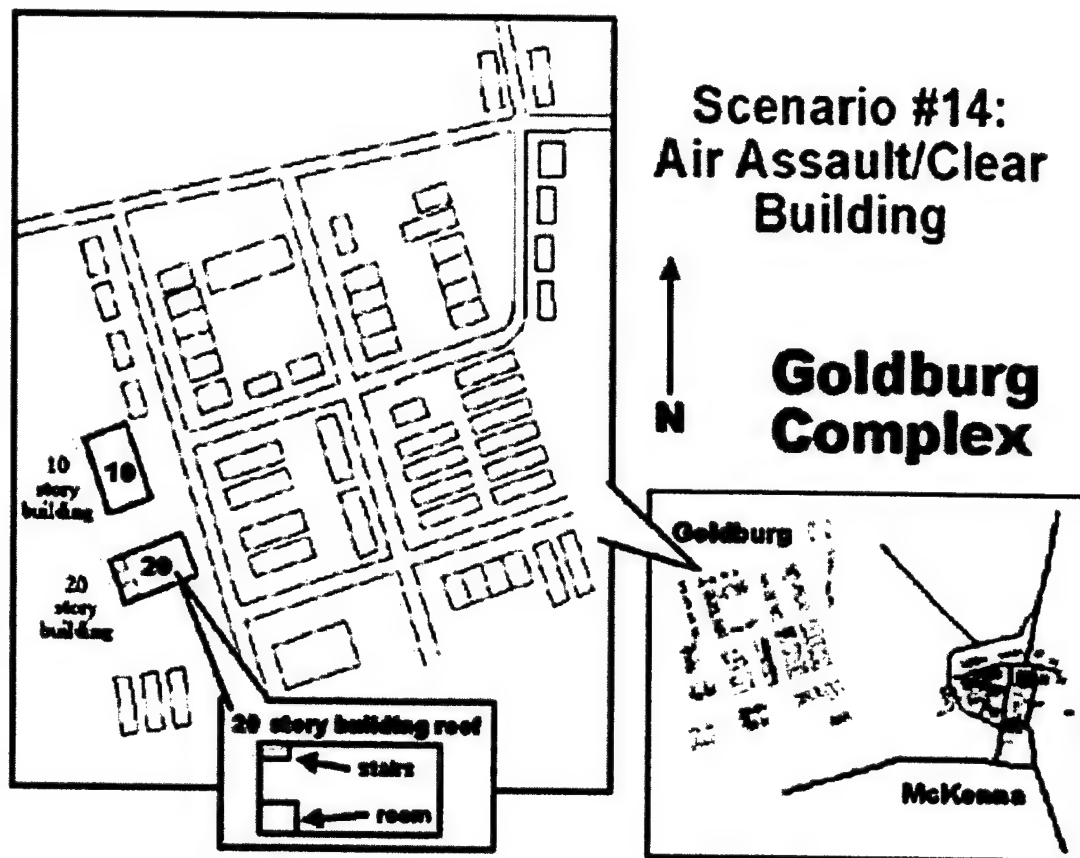
Your Mission: 2d Squad, your squad, will lead the assault on the 20th floor. 2d Squad will pass through the 1st Squad securing the roof and start to clear the building, floor-by-floor. 2d Squad will leave 2 men on each floor that it clears to secure that floor. Because the building interior is heavily encased in glass no flashbang devices should be used. Smoke to conceal your movement should be used sparingly.

Rules of Engagement: The town population of Krasno is considered hostile. However, given that the town population is not completely hostile, the rules of engagement remain restrictive. There will be no weapon firing except in self-defense. Self-defense is defined as a serious threat to life or limb. The use of deadly force is authorized. Armed civilians and OPFOR troops actively engaging U.S. soldiers will be fired on. Civilians found to be armed, but not firing on U.S. troops are to be disarmed, detained, and processed through company channels. Weapons control status is tight.

Your immediate task is to brief your squad members and organize the squad to complete the mission. Call signs remain constant.

What are your questions?

The scenario will begin once you have briefed your subordinates.



Scenario Description

| Scenario Set-Up and Demonstrated Technologies | | |
|---|----------------------------------|---|
| Time of Day: 0630 | Technologies | |
| Weather: Clear | Crowd Behavior | |
| Wind effect: 5 kph | Armed Civilian | |
| Wind direction: From N.E. | Follow Me/IC Station Keeping | X |
| Exterior Lighting: On | Smoke Grenade | X |
| | Stun/Flashbang Grenade | |
| | Hand Emplaced/Satchel Charge | |
| | Hand-Launched Signal Flares | |
| | After-Action Review (AAR) System | X |

The unit is always the 2d Squad of the 2d Platoon.

Mission Overview: The battalion is conducting a combined air assault and ground assault operation to seize the town of Krasno (pronounced krāz·nō). The company is the main effort, conducting the air assault. Two other companies are conducting a simultaneous ground assault. Our company commander has ordered 1st Platoon to conduct an air assault to seize the 10-story building. 2d Platoon will simultaneously conduct an air assault to seize the 20-story high rise building. 3d Platoon is the company reserve and is prepared to reinforce 2d Platoon, on order. Each platoon will have four helicopters at 30-second intervals. 2d Platoon Leader has ordered the 1st Squad to be the security element and will conduct the initial assault. Its mission is to secure the roof with 1 fire team and establish a toehold on the top floor of the building, clearing the steps to the 20th floor for the next squad. Access to the follow-on floors is gained by using the stairwell steps. 2d Squad is second in order. It will pass through the 1st Squad and start to clear the building, floor-by-floor. 3d Squad is to follow the 2d Squad and be prepared to assume clearing responsibilities on order. Once 2d and 3d Squads have passed through, the 1st Squad will follow 3d Squad as the platoon reserve. 1st Squad will be prepared to assume clearing duties, on order. Each squad will leave 2 men on each floor that it clears to secure that floor. The platoon command post will initially be in the shed on the roof of the building. The platoon casualty collection point (CCP) is initially the platoon CP, located on the roof. As floors are cleared past the 10th floor, the CCP will be established on the landing of the last secured floor. The ROE is restrictive. No fires will be placed into the adjacent 10-story building unless a target is positively identified firing on the 2d Platoon. If enemy troop movement is noticed in the 10-story building, the platoon leader will be notified immediately. Even then, coordination must be obtained from the platoon leader to fire into that building. Armed OPFOR personnel in the 20-story high rise building are considered hostile and will be fired on.

| Prior to Beginning Scenario | |
|-----------------------------|--|
| 1. | Start and End points are the 20 story high rise (Goldberg). |
| 2. | Add 2 OPFOR on the 20th floor. 1 is live OPFOR on desktop. |
| 3. | Add 2 dead OPFOR on the roof. |
| 4. | No interior lights on either building. |
| 5. | Add furniture to hallways of 20th floor of building. |
| 6. | SAF 1st Squad already on the roof (1 fire team) positioned along the roof perimeter. Must be in position when the 2d Squad exits their helicopter. |
| 7. | Be prepared to have SAF 3d Squad moving on stairwell from the 20th floor to the 19th floor, relieving the 2d Squad. |

Scenario: This scenario takes place at dawn. The operation order has been issued by the platoon leader. The scenario begins with an aerial view of building from a high angle, at a distance, with helicopter landing on the roof of the building. Would like helicopter noise added to background. 1 DI SAF squad on roof top moving to secure the building top. As the helicopter departs, 2d Squad will then teleport to the roof of the high rise, just outside their helicopter. DI SAF players from the 1st Squad are already on the roof. The 2d Squad will move through the 1st Squad and commence clearing the top floor. There will be 2 dead OPFOR on the roof. There will be 2 more live OPFOR on the 20th floor, one is immersed. Because the building interior is heavily encased in glass no flashbang devices should be used. Smoke to conceal movement

should be used sparingly. The squad leader must keep the platoon leader informed. If he doesn't, the platoon leader will repeatedly ask for SITREPs. The use of TAC lights is authorized to assist clearing the various rooms on each floor. ENDEX will occur when the mission is accomplished or when the squad can no longer perform its mission.

Appendix C. Culminating Event Questionnaires

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Biographical Information Questionnaire

ID _____

Date _____

Please fill in the blank or mark or circle the appropriate response.

1. What is your age? _____ Years 2. MOS _____ 3. Rank _____

4. Time in service: Years _____ Months _____

5. What is your current duty position? _____

How long in this position? _____

6. What Army training courses have you completed? Check all that apply.

| | | |
|-------------------------|----------------|--------------------------------|
| _____ OSUT/AIT | _____ PLDC | _____ BNCOC |
| _____ BFV Leader Course | _____ Airborne | _____ Combat Life Saver Course |
| _____ Air Assault | _____ Ranger | _____ Other (specify) |

7. How susceptible to motion or car sickness do you feel you are?

| | | | | | | |
|----------------|---|---|---------|---|---|----------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| very mildly | | | average | | | very highly |

8. Do you have normal or corrected to normal 20/20 vision? Yes No

9. Are you color blind? Yes No

10. Are you _____ right handed? _____ left handed?

11. My level of confidence in using computers is

| | | | | |
|-----|---|---------|---|------|
| 1 | 2 | 3 | 4 | 5 |
| low | | average | | high |

12. How many hours per week do you use computers? _____ hours per week

13. How many times in the last year have you experienced a virtual reality game or entertainment?

0 1 2 3 4 5 6 7 8 9 10 11 12+

14. How often have you trained at a MOUT site since basic training (**NOT** including demonstrations)?

____ not since basic training ____ 1-3 times ____ more than 3 times

15. Have you ever participated in close quarter combat (room clearing) training **EXCEPT** for a demonstration?

Yes No

16. Have you ever participated in a demonstration at a MOUT site?

Yes No

17. Have you ever been in a Virtual simulator at the Land Warrior Test Bed before?

Yes No

If YES, when (approximate month and year) and which one(s)? (Describe if you cannot remember the name)

18. Have you had any other experience with military computer simulations?

Yes No

If yes, please describe briefly or give the names of the simulators.

2002 Simulator Capability Questionnaire

ID Number: _____ Today's Date: _____

Section I. Simulator Capabilities

Please rate your ability to perform each task in the simulator

| | Very Good | Good | Poor | Very Poor |
|---|-----------|------|------|-----------|
| 1. Move through open areas as a widely separated group. | | | | |
| 2. Move according to directions. | | | | |
| 3. Maneuver around obstacles. | | | | |
| 4. Move in single file. | | | | |
| 5. Maneuver below windows. | | | | |
| 6. Maneuver close to others. | | | | |
| 7. Determine other team/squad members' positions. | | | | |
| 8. Maintain position relative to other team/squad members. | | | | |
| 9. Maneuver around corners. | | | | |
| 10. Locate assigned areas of observation, e.g. across the street. | | | | |
| 11. Look around corners. | | | | |
| 12. Visually locate the source of enemy fire. | | | | |
| 13. Determine the source of enemy fire by sound. | | | | |
| 14. Distinguish between friendly and enemy fire. | | | | |
| 15. Identify civilians. | | | | |
| 16. Communicate enemy location to team member. | | | | |
| 17. Take hasty defensive positions. | | | | |
| 18. Aim weapon. | | | | |
| 19. Fire weapon in short bursts. | | | | |
| 20. Fire weapon accurately. | | | | |
| 21. Identify covered and concealed routes. | | | | |
| 22. Identify areas that mask supporting fires. | | | | |
| 23. Coordinate with other squad members. | | | | |
| 24. Execute the assault as planned. | | | | |
| 25. Move quickly to the point of attack. | | | | |
| 26. Assume defensive positions. | | | | |
| 27. Identify safe and danger areas. | | | | |
| 28. Locate support team positions. | | | | |
| 29. Locate fire team buddy positions. | | | | |
| 30. Take position to one side of the doorway. | | | | |
| 31. Move quickly through doorways. | | | | |
| 32. Take a tactical position while within a room. | | | | |
| 33. Scan the room quickly for hostile combatants. | | | | |
| 34. Engage targets within a room. | | | | |
| 35. Identify non-combatants within a room. | | | | |
| 36. Move past furniture in a room. | | | | |
| 37. Maneuver past other personnel in a room. | | | | |

| Section I continued: Please rate your ability to perform each task in the simulator | | | | |
|--|------------------|-------------|-------------|------------------|
| | Very Good | Good | Poor | Very Poor |
| 38. Understand verbal commands. | | | | |
| 39. Identify sector of responsibility. | | | | |
| 40. Communicate SPOT reports to squad leader. | | | | |
| 41. Execute planned route. | | | | |
| 42. Identify assigned sectors of observation. | | | | |
| 43. Move close to walls. | | | | |
| 44. Scan from side-to-side. | | | | |
| 45. Scan vertically. | | | | |
| 46. Identify enemy soldiers. | | | | |
| 47. Estimate distances from self to a distant object. | | | | |
| 48. Climb up or down stairs. | | | | |
| 49. Locate enemy soldiers inside buildings firing at your unit. | | | | |
| 50. Determine the direction enemy rounds are coming from. | | | | |
| 51. Use fragmentation grenades. | | | | |
| 52. Use hand-held illumination (flares). | | | | |
| 53. Use flash-bang grenades to help clear rooms. | | | | |
| 54. Employ tactical hand-held smoke grenades. | | | | |

| Section II: Lighting Assessment | | | | | |
|---|-----------------------|--------------|-----------------------------------|-----------------|--------------------------|
| Indicate how much you agree or disagree with each of the following statements. | | | | | |
| | Strongly Agree | Agree | Neither Agree Nor Disagree | Disagree | Strongly Disagree |
| 1. Time of day was accurately reflected by the amount of light demonstrated on the simulator. | | | | | |
| 2. Street lights were realistic. | | | | | |
| 3. Shooting out street lights to reduce their impact on the mission was realistic. | | | | | |
| 4. Building interior lights were realistic. | | | | | |
| 5. Shooting out building interior lights to reduce their impact on the mission was realistic. | | | | | |
| 6. Night conditions were accurately portrayed in the simulator. | | | | | |

Section III: Dynamic Terrain Server

Indicate how much you agree or disagree with each of the following statements.

| | Strongly Agree | Agree | Neither Agree Nor Disagree | Disagree | Strongly Disagree |
|--|----------------|-------|----------------------------|----------|-------------------|
| 1. The rubble effect realistically portrays that found in a MOUT environment. | | | | | |
| 2. I was able to distinguish rubble from a distance. | | | | | |
| 3. The effect created by the blow hole (C4 or AT-8 fire) is realistic. | | | | | |
| 4. The blow hole (C4 or AT-8 fire) created a hole exactly where it was to be placed. | | | | | |
| 5. The sound simulation of the blow hole "burst" (C4 or AT-8 fire) was realistic. | | | | | |
| 6. The flash simulation of the blow hole "burst" (C4 or AT-8 fire) was realistic. | | | | | |
| 7. Battlefield environment (wrecked vehicles, building damage, civilians and vehicles moving about, etc.) was realistically portrayed. | | | | | |

Section IV: After Action Review (AAR) Evaluation

Please indicate how much you agree or disagree with each of the following statements by placing a check mark in the appropriate cell.

| | Strongly Agree | Agree | Neither Agree nor Disagree | Disagree | Strongly Disagree |
|--|----------------|-------|----------------------------|----------|-------------------|
| 1. The AAR system was effective in displaying movement outside of buildings. | | | | | |
| 2. The AAR system was effective in displaying movement inside of buildings. | | | | | |
| 3. The AAR system was effective in replaying communications. | | | | | |
| 4. The AAR system made it easy to determine what happened during a mission. | | | | | |
| 5. The AAR system made it easy to determine why things happened the way they did during a mission. | | | | | |
| 6. The AAR system made it easy to determine how to do better in accomplishing the mission. | | | | | |
| 7. The AAR system made it easy to determine the order in which key events occurred during the mission. | | | | | |
| 8. The AAR system was more effective than conducting an AAR without any visual or audio playback (just talking). | | | | | |

Semi-Automated Force (SAF) Performance Questionnaire

ID Number: _____

Today's Date: _____

Leadership position held during today's exercise (*Check one*):

_____ Squad Leader _____ Alpha Team Leader _____ Bravo Team Leader

How well did the semi-automated force fire teams perform the following tasks in today's exercises compared with soldiers in the simulators?

| SAF players were... | Much worse than soldiers | Slightly worse than soldiers | About the same as soldiers | Slightly better than soldiers | Much better than soldiers |
|---|--------------------------|------------------------------|----------------------------|-------------------------------|---------------------------|
| 1. Move through open areas. | | | | | |
| 2. Maintain position relative to other squad or team members. | | | | | |
| 3. Communicate information to squad leader. | | | | | |
| 4. Locate known or suspected enemy positions. | | | | | |
| 5. Clear a room. | | | | | |
| 6. Clear a building. | | | | | |
| 7. Distinguish between friendly and enemy positions. | | | | | |
| 8. Take hasty defensive positions. | | | | | |
| 9. Fire weapons automatically. | | | | | |
| 10. Move to designated location. | | | | | |
| 11. Change formation. | | | | | |
| 12. Support by fire. | | | | | |
| 13. Deliver suppressive fire. | | | | | |
| 14. Perform fire and movement. | | | | | |
| 15. React to contact | | | | | |
| 16. React to ambush. | | | | | |
| 17. Move through built-up areas. | | | | | |

Training Effectiveness Questionnaire

ID Number: _____

Today's Date: _____

Position Held During Today's Exercise (*Check one*):

_____ Squad Leader _____ Alpha Team Leader _____ Bravo Team Leader

| As a result of today's exercises, my ability to perform the following tasks was changed as follows. | No Improvement | Slight Improvement | Moderate Improvement | Vast Improvement |
|---|----------------|--------------------|----------------------|------------------|
| 1. React to Contact Battle Drill. | | | | |
| 2. Assess the tactical situation. | | | | |
| 3. Control of squad/fire team movement during the assault. | | | | |
| 4. Locate known or suspected enemy positions. | | | | |
| 5. Clear a room. | | | | |
| 6. Clear a building. | | | | |
| 7. Control squad or fire team movement while NOT in contact with the enemy. | | | | |
| 8. Plan a tactical operation. | | | | |
| 9. Control your squad or fire team. | | | | |
| 10. Coordinate activities with your chain of command. | | | | |
| 11. Squad/fire team communication and coordination. | | | | |

2002 Voice Recognition Questionnaire

ID Number: _____

Today's Date: _____

Indicate how much you agree or disagree with each of the following statements.

| | Strongly Agree | Agree | Neither Agree Nor Disagree | Disagree | Strongly Disagree |
|---|----------------|--------|----------------------------|----------|-------------------|
| 1. It was easy to give voice commands that SAF could understand. | | | | | |
| 2. It was easy to learn to give voice commands to SAF. | | | | | |
| 3. It was easy to tell if SAF recognized or understood my voice commands. | | | | | |
| 4. Giving voice commands to SAF came naturally. | | | | | |
| 5. I frequently gave voice commands that SAF did not recognize. | | | | | |
| 6. The SAF responded to my verbal commands. | | | | | |
| 7. The verbal responses were appropriate for the various situations. | | | | | |
| 8. What percentage of time was SAF unable to recognize your voice commands correctly on the first try? (circle response) | <20% | 20-39% | 40-60% | 61-80% | >80% |
| 9. What percentage of time did SAF respond incorrectly to your voice commands? (circle response) | <20% | 20-39% | 40-60% | 61-80% | >80% |

Date _____
Time _____

ID _____

Symptom Checklist

Instructions: Please indicate the severity of symptoms that apply to you right now by circling the appropriate word.

- | | |
|--|-----------------------------|
| 1. General discomfort | None Slight Moderate Severe |
| 2. Fatigue | None Slight Moderate Severe |
| 3. Headache | None Slight Moderate Severe |
| 4. Eye Strain | None Slight Moderate Severe |
| 5. Difficulty focusing | None Slight Moderate Severe |
| 6. Salivation increased | None Slight Moderate Severe |
| 7. a. Warm Sweating (from temperature or exertion) | None Slight Moderate Severe |
| b. Cold Sweating (from discomfort or nervousness) | None Slight Moderate Severe |
| 8. Nausea | None Slight Moderate Severe |
| 9. Difficulty concentrating | None Slight Moderate Severe |
| 10. "Fullness of the Head" | None Slight Moderate Severe |
| 11. Blurred Vision | None Slight Moderate Severe |
| 12. a. Dizziness with eyes open | None Slight Moderate Severe |
| b. Dizziness with eyes closed | None Slight Moderate Severe |
| 13. Vertigo | None Slight Moderate Severe |
| 14. *Stomach awareness | None Slight Moderate Severe |
| 15. Burping | None Slight Moderate Severe |
| 16. Other (describe): _____ | |

* Stomach awareness is usually used to indicate a feeling of discomfort, which is just short of nausea.

Leader Post-Experimental Group Interview

(Circle: Squad Leader, Alpha Team Leader, and Bravo Team Leader)

Interviewer _____

Date: _____

1. Do you think that the simulators you used today were a useful training tool (that is, did you learn from today's experience)?

What did you learn?

2. Do you think that this training will affect your performance in a real world setting?

3. Where in the Army training system do you think that this type of training would be most appropriate or useful?

4. In today's exercises, friendly and enemy forces were sometimes actual soldiers, and sometimes semi-automated forces (SAF) under the control of an operator. Were you able to identify which were SAF and which were soldiers?

If so, how?

5. Did you do anything differently when interacting with SAF vs. the real soldiers?

If so, what?

6. Did the use of SAF affect what you learned?

If so, what?

7. What additional capabilities do you think SAF should have in order to be effective from a training standpoint?

8. What did you like most about the scenarios?

9. What did you like least about the scenarios?

10. Could these scenarios be used to practice decision-making skills?

Why or why not?

11. Were the After Action Reviews (AARs) provided after the exercises helpful?

Why or why not?

12. What were the best aspects of the AAR system?
13. What were the worst aspects of the AAR system?
14. Was anything missing from the AAR system?
15. What additional features do you think the AAR system should have?
16. What part of the simulation (tasks, terrain, etc.) was the most realistic?
17. What part of the simulation (tasks, terrain, etc.) was the least realistic?
18. What was the most difficult task to perform in the simulator?
19. Did you find any aspects of the simulator or simulation distracting?
If so, what?
20. Do you think your lack of familiarity with the simulators affected your performance in the exercises, or did you have enough training?
21. What is your overall impression of the night simulation? Were some aspects more realistic than others? If so, what?
22. Was the automatic voice recognition helpful when controlling SAF? Does it need additional capabilities? If so, what?

Soldier Post-Experimental Group Interview

Interviewer _____

Date: _____

1. Do you think that the simulators you used today were a useful training tool (that is, did you learn from today's experience)?

What did you learn?

2. Do you think that this training will affect your performance in a real world setting?

3. Where in the Army training system do you think that this type of training would be most appropriate or useful?

4. In today's exercises, friendly and enemy forces were sometimes actual soldiers, and sometimes semi-automated forces (SAF) under the control of an operator. Were you able to identify which were SAF and which were soldiers?

If so, how?

5. Did you do anything differently when interacting with SAF vs. the real soldiers?

If so, what?

6. Did the use of SAF affect what you learned?

If so, what?

7. What additional capabilities do you think SAF should have in order to be effective from a training standpoint?

8. What did you like most about the scenarios?

9. What did you like least about the scenarios?

10. Could these scenarios be used to practice decision-making skills?

Why or why not?

11. Were the After Action Reviews (AARs) provided after the exercises helpful?

Why or why not?

12. What were the best aspects of the AAR system?

13. What were the worst aspects of the AAR system?

14. Was anything missing from the AAR system?
15. What additional features do you think the AAR system should have?
16. What part of the simulation (tasks, terrain, etc.) was the most realistic?
17. What part of the simulation (tasks, terrain, etc.) was the least realistic?
18. What was the most difficult task to perform in the simulator?
19. Did you find any aspects of the simulator or simulation distracting?
If so, what?
20. Do you think your lack of familiarity with the simulators affected your performance in the exercises, or did you have enough training?
21. What is your overall impression of the night simulation? Were some aspects more realistic than others? If so, what?

CE Unit Evaluation Check List

Date: _____ Time: _____ Squad 1 2 3 Day 1 2 Scenario 6A 6B 7A 7B 10 11 13 14

| | | | | |
|-------------|-------|-------|-------|------|
| 1 | 2 | 3 | 4 | 5 |
| < 20 | 20-40 | 41-60 | 61-80 | > 80 |
| (% of Time) | | | | |

Each statement begins with, "In my opinion, this unit..."

1. ____ demonstrated knowledge and expertise during the planning phase commensurate with leader rank and time in grade.
2. ____ used all available enemy and friendly information to form a plan that followed current Army doctrine.
3. ____ employed proper movement techniques to the objective. (through town to the objective)
4. ____ issued clear and concise instructions to subordinate personnel during movement. (through town to the objective)
5. ____ maintained positive control of unit actions during initial enemy contact. (react to contact)
6. ____ adapted the plan and provided clear precise instructions as the enemy situation developed.
7. ____ revised the plan as necessary following approved Army doctrine.
8. ____ maintained positive control of soldiers during sustained enemy contact. (one team support, one move, and rotate teams)
9. ____ demonstrated knowledge of enemy/friendly status during sustained enemy contact. (number of rooms cleared and number of enemy /friendly WIA/KIA)
10. ____ provided the chain of command with accurate situation reports when asked or when presented with an opportunity during enemy contact. (SITREPS conveyed actual situation)
11. ____ consolidated/reorganized to secure objective or continue with another mission.
12. ____ used appropriate control measures (weapons) throughout mission. (radio, hand and arm signals, smoke, flares, grenades, explosives)
13. ____ expeditiously filled key leader positions as casualties occurred. (SL/TL)
14. ____ successfully accomplished the mission by demonstrating proper leadership and tactics.

Comments: (If unit became combat ineffective during this mission state the cause.)

Overall Rating: _____

Evaluator: _____

Appendix D. Daily Schedules

22, 26, 28 Aug 2002

| | |
|------|--|
| 730 | Set-up |
| 0800 | Soldiers Arrive |
| | Soldier Welcome and Orientation |
| | Questionnaire Administration |
| | <ul style="list-style-type: none">• Assign Soldier Roles• Biographical Questionnaire |
| | Symptom Checklist |
| 0900 | Train-up Phase I: All Soldiers – Familiarization Scenario |
| | <ul style="list-style-type: none">• SVS – Move shoot & communicate• ASTi Radio |
| 1000 | Train-up Phase II: Multiple Tracks |
| | <ul style="list-style-type: none">• Voice Control of SAF – B Team Leader• Mission Background/Mout Tactics/Unit SOP – All others |
| 1030 | Familiarization Exercise -- Scenario 4: Roving Patrol |
| | <ul style="list-style-type: none">• Receive orders and plan (10 minutes)• Move to SVSs and calibrate weapons (10 minutes)• Conduct exercise (30 minutes)• Break (10 minutes)• Repeat Exercise (30 minutes) |
| 1200 | Lunch |
| 1300 | Training Exercise 1 – Scenario 6A (6B on 26 August): Hostage Rescue |
| | <ul style="list-style-type: none">• Receive orders and plan - (10 minutes)• Move to SVSs and calibrate weapons (10 minutes)• Conduct exercise (30 minutes)• AAR (20 minutes)• Break (10 minutes) |
| 1420 | Training Exercise 2 -- Scenario 7A (7B on 26 August): Deliberate Attack (Same break-out as Training Exercise 1) |
| 1540 | Training Exercise 3 – Scenario 14: Air Assault & Clear Building (Goldberg) (Same break-out as Training Exercise 1) |
| 1700 | Questionnaires & Interviews |
| | <ul style="list-style-type: none">• Symptom Checklist |
| 1710 | Release Soldiers |

23, 27, 29 Aug 2002

0730 Set-up
0800 Soldiers Arrive
• Symptom Checklist
0830 Training Exercise 4 – Scenario 13: Deliberate Attack
• Receive orders and plan -- (10 minutes)
• Move to SVSs and calibrate weapons (10 minutes)
• Conduct exercise (30 minutes)
• AAR (20 minutes)
• Break (10 minutes)
0950 Training Exercise 5 – Scenario 10: Crowd Control
(Same break-out as Training Exercise 4)
1110 Lunch
1210 Training Exercise 6 – Scenario 11: Downed Helicopter
(Same break-out as Training Exercise 4)
1330 Training Exercise 7 -- Scenario 6B (6A on 26 August): Hostage Rescue
(Same break-out as Training Exercise 4)
1450 Training Exercise 8 – Scenario 7B (7A on 26 August): Deliberate Attack
(Same break-out as Training Exercise 4)
1610 Questionnaires & Interviews
• Questionnaires
• Interviews
1700 Release Soldiers